Engineering Village™

1.

Accession number: 20192607106201

Title: **Hydrocarbon accumulation conditions of Permian volcanic gas reservoirs in the western Sichuan Basin**

Title of translation: **四川盆地西部二叠系火山岩气藏成藏条件分析**

Authors: Luo, Bing ; Xia, Maolong ; Wang, Hua ; Fan, Yi ; Xu, Liang ; Liu, Ran ; Zhan, Weiyun

Author affiliation: Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: February 25, 2019

Publication year: 2019

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to figure out the hydrocarbon accumulation conditions of Permian volcaniclastic gas reservoirs in the western Sichuan Basin, we analyzed the hydrocarbon accumulation characteristics of volcaniclastic gas reservoirs in this area in terms of reservoir, gas source, play and trap. It is indicated that the favorable conditions for the hydrocarbon accumulation of volcaniclastic gas reservoirs in the Jianyang area in the western Sichuan Basin are as follows. First, in the Well Yongtan 1, vocaniclastic lava of effusive facies is dominant, and superimposed with late alteration and dissolution, pore-type reservoirs with devitrified dissolution micropores as the main reservoir space are developed. Second, geochemical analysis and comparison on natural gas reveal that the gas of the volcanic gas reservoirs in the Well Yongtan 1 is mainly derived from the Qiongzhusi

Formation of Lower Cambrian. Cambrian quality source rocks of great thickness are developed in Deyang-Anyue rift in the Jianyang area and they provide sufficient gas sources for the formation of gas reservoirs. Third, volcaniclastic reservoirs and Cambrian source rocks constitute a proximal high-efficiency source-reservoir assemblage with reservoir in the upper part and source rock in the lower part, hydrocarbon source faults communicate source rocks with reservoirs effectively, and the direct caprock of Longtan Formation mudstone of Upper Permian and the regional caprock of Triassic gypsum rock are developed. Thus, a good assemblage of source, reservoir and caprock is formed. Fourth, tectonic-lithologic (stratigraphic) composite traps are developed in Chengdu-Jianyang area and their favorable gas bearing area is preliminarily confirmed to be 1 300 km, presenting a great exploration potential of natural gas. In conclusion, the volcaniclastic gas reservoirs in western Sichuan Basin are much different from Zhougongshan basalt gas reservoir in southwestern Sichuan Basin in terms of hydrocarbon accumulation conditions. It is predicted that the distribution area of vocaniclastic rocks in the Zhongjiang-Santai area is over 4 000 km, and their hydrocarbon accumulation conditions of volcanic gas reservoirs are similar to those in the Jianyang area, so this is a favorable area for exploration breakthrough in the next stage.

Number of references: 20

Main heading: Petroleum prospecting

Controlled terms: Analytical geochemistry - Dissolution - Exploratory geochemistry - Gases - Hydrocarbons - Natural gas - Natural gas wells - Petroleum reservoirs - Stratigraphy - Volcanic rocks - Volcanoes

Uncontrolled terms: Favorable exploration area - Gas accumulation - Hydrocarbon sources - Permian - Sichuan Basin - Vocaniclastic lava - Western Sichuan

Classification code: 481.1 Geology - 481.2 Geochemistry - 482.2 Minerals - 484 Seismology - 512 Petroleum and Related Deposits - 522 Gas Fuels - 802.3 Chemical Operations - 804.1 Organic Compounds

Numerical data indexing: Area 1.30e+09m2, Area 4.00e+09m2

DOI: 10.3787/j.issn.1000-0976.2019.02.002

Database: Compendex

2.

Accession number: 20192607106211

Title: **Risk assessment of drilling site operation based on the structural equation and Monte Carlo Method**

Title of translation: **基于结构方程与蒙特卡洛方法的钻井现场作业风险评价**

Authors: Zhao, Chunlan ; Yin, Huimin ; Wang, Bing ; Fan, Xiangyu ; Wu, Hao

Author affiliation: School of Science, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

School of Computer Science, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Exploration Division of PertroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Corresponding author: Fan, Xiangyu (93334271@qq.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Issue date: February 25, 2019

Publication year: 2019

Pages: 84-93

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In the risk assessment of drilling site operation, the relevance between monitored data and actual on-site operation is not strong. In view of this, the structural equation model (SEM) integrated with the Monte Carlo Method (MC) was applied as a new methodology to evaluate the on-drilling-site operation risks. First, risk factors were constituted and their relevance and weights were obtained by the SEM, then the key risk factors were determined. Then, the analog values of potential data were got based upon data distribution. Finally, risk degrees were obtained in combination with SEM risk consequence weights and accident consequence degree risk degrees identified from the on-site operation, and were applied in the judgment of risk levels. This methodology was applied in a case study of a well in

a gas field, Sichuan Basin. The following findings were achieved. (1) Compared with the other methods, this new methodology determined the relevance of various factors and disadvantages of each factor weight, providing a new approach for the on-site operation risk assessment. (2) The factors of operation behaviors and environmental considerat ion had little impact on the drilling risks but the man - agement factor was the most influential factor. (3) The two key factors of non-conformity and general equipment defects were determined and their correlation coefficient was 0.57. (4) A series of required sample data was obtained according to the distribution characteristic of each risk variable and probability distribution of drilling risks was thus achieved, which made the assessment results more consistent with the actual situation. In conclusion, this new methodology provides not only a better way to apply the monitored on-site data to evaluate the drilling risk levels, but a reference for risk management i n drilling sites.

Number of references: 24

Main heading: Risk assessment

Controlled terms: Infill drilling - Monte Carlo methods - Probability distributions - Risk management

Uncontrolled terms: Potential variable - Risk degree - Risk factors - Risk levels - Site operations - Structural equation modeling

Classification code: 511.1 Oil Field Production Operations - 914.1 Accidents and Accident Prevention - 922.1 Probability Theory - 922.2 Mathematical Statistics

DOI: 10.3787/j.issn.1000-0976.2019.02.012

Database: Compendex

3.

Accession number: 20192206992459

Title: **Characteristics of multi-scale pore structure of coal and its influence on permeability**

Title of translation: **煤的多尺度孔隙结构特征及其对渗透率的影响**

Authors: Pan, Jienan ; Zhang, Zhaozhao ; Li, Meng ; Wu, Yawen ; Wang, Kai

Author affiliation: Institute of Resources & Environment, Henan Polytechnic University, Jiaozuo; Henan; 454000, China

Henan Collaborative Innovation Center of Coalbed Methane and Shale Gas for Central Plains Economic Region, Jiaozuo;

Henan; 454000, China

Corresponding author: Zhang, Zhaozhao (zhangzhao_2017@163.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: January 25, 2019

Publication year: 2019

Pages: 64-73

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Due to the uneven distribution of pore size in coal and its wide distribution range, it is difficult to effectively characterize the multi-scale pore structure of coal by a single method. In this paper, the multi-scale pore structure characteristics of coal were analyzed comprehensively by using scanning electron microscope, low-temperature liquid nitrogen adsorption, high-pressure mercury intrusion and constant-rate mercury intrusion. In addition, the effects of metamorphism on the volume and specific surface area of pores in coal were revealed, and the relationships between coal rock permeability and pore structure characteristic parameters were described. And the following research results were obtained. First, with the increase of coal metamorphism, the volume and specific surface area of nanopores in coal decrease first and then increase, and they reach the minimum value when Ro, max is about 1.8%. Second, the pore and throat radii of coal samples are overall in the form of normal distribution. And with the increase of coal metamorphism, the pore radius corresponding to the maximum distribution frequency increases. Third, the samples of low-rank bituminous coal are the highest in throat radius distribution range, connected throat radius and average throat radius. Fourth, the samples of anthracite coal are the lowest in throat radius distribution range and connected throat radius. Fifth, there is a single main peak in the distribution of pore throat ratios of low- and medium- rank bituminous coal samples, and the pore throat ratios corresponding to the main peak is relatively low. Sixth, the permeability of coal is in a positive correlation with porosity and an average throat radius, and in a negative correlation with an average pore throat ratio, but in no

obvious correlation with an average pore radius.

Number of references: 37

Main heading: Anthracite

Controlled terms: Bituminous coal - Coal - Gas adsorption - Liquefied gases - Liquid nitrogen - Mechanical permeability - Mercury (metal) - Nanopores - Normal distribution - Pore size - Pore structure - Scanning electron microscopy - Specific surface area - Temperature

Uncontrolled terms: Degree of metamorphism - High pressure mercury - Mercury intrusion - Negative correlation - Nitrogen adsorption - Positive correlations - Structure characteristic - Structure of coal

Classification code: 524 Solid Fuels - 549.3 Nonferrous Metals and Alloys excluding Alkali and Alkaline Earth Metals - 641.1 Thermodynamics - 761 Nanotechnology - 802.3 Chemical Operations - 804.2 Inorganic Compounds - 922.1 Probability Theory - 931.2 Physical Properties of Gases, Liquids and Solids - 933 Solid State Physics

Numerical data indexing: Percentage 1.80e+00%

DOI: 10.3787/j.issn.1000-0976.2019.01.007

Database: Compendex

4.

Accession number: 20192206992465

Title: **Automatic defect identification technology of digital image of pipeline weld**

Title of translation: **管道焊缝数字图像缺陷自动识别技术**

Authors: Dong, Shaohua ; Sun, Xuan ; Xie, Shuyi ; Wang, Mingfeng

Author affiliation: College of Mechanical and Transportation Engineering, China University of Petroleum <Beijing>, Beijing; 102249, China

China University of Petroleum-Beijing at Karamay, Karamay; Xingjiang; 834000, China

Operation District of Hutubi Gas Storage, PetroChina Xinjiang Oilfield Company, Hutubi; Xingjiang; 831200, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: January 25, 2019

Publication year: 2019

Pages: 113-117

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Digital image of pipeline weld is an important basis for the reliability management of pipeline welds. However, the error rate of artificial discrimination is high. In order to increase the defect identification accuracy ofdigital image of pipeline weld, we adopted several methods (e.g. multiple edge detection, detection channel and threshold segmentation) to carry out image processing on the image defects of pipeline welds. Then, a defect characteristic database on the digital images of pipeline welds was constructed, including grayscale difference, equivalent area (S/C), circularity, entropy, correlation and other parameters. Furthermore, a multi-classifier construction (SVM) model was established. Thus, the classification and evaluation on the defects in the digital images of pipeline welds were realized. Finally, an automatic defect identification software fordigital image of pipeline weld was developed and verified on site. And the following research results were obtained. First, after image processing, the edge detection results obtained by Canny and other algorithms are satisfactory when there is no noise. In the case of noise, however, pseudo-edge emerges in the detection results. In this case, the automatic threshold selection method shall be adopted to detect the image edge to obtain the rational threshold. Second, there are 14 parameters in the defect characteristic database, including shape characteristic, lamination characteristic and image length pixel. Third, by virtue of the SVM classification model, the shape characteristics of each type of defect can be clarified, and the defect characteristics can be identified, such as crack, slag inclusion, air hole, incomplete penetration, non-fusion and strip. Based on field application, the following results were obtained. First, this automatic defect identification technology is applicable to quality identification and evaluation of various defects in pipeline welds. Second, its identification accuracy is higher than 90%. Third, by virtue of this technology, automatic defect identification and evaluation of digital image of pipeline weld is realized. In conclusion, these research results help to ensure the safe operation of pipelines.

Number of 17

references:

Main heading: Pipelines

Controlled terms: Automatic identification - Automation - Classification (of information) - Database systems - Defects - Image segmentation - Pipeline processing systems - Quality control - Slags - Software design - Software engineering - Support vector machines - Welds

Uncontrolled terms: Automatic threshold selection - Classification and evaluations - Defect identification - Digital image - Identification accuracy - Pipeline welds - Quality identifications - SVM classification

Classification code: 538.2 Welding - 619.1 Pipe, Piping and Pipelines - 716.1 Information Theory and Signal Processing - 722.4 Digital Computers and Systems - 723 Computer Software, Data Handling and Applications - 731 Automatic Control Principles and Applications - 913.3 Quality Assurance and Control - 951 Materials Science

Numerical data indexing: Percentage 9.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.01.013

Database: Compendex

5.

Accession number: 20192206992469

Title: **Thoughts on the establishment of a natural gas purification base in China**

Title of translation: **创建中国天然气净化基地的思考**

Authors: Gao, Jin ; Yu, Zehan ; Fu, Shi ; Qiu, Bin

Author affiliation: Chongqing Natural Gas Purification Plant, PetroChina Southwest Oil & Gasfield Company, Chongqing; 430011, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: January 25, 2019

Publication year: 2019

Pages: 138-143

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The Chongqing Natural Gas Purification Plant of PetroChina Southwest Oil & Gasfield Company will build a natural gas purification base of China as its developing strategic goal. To clarify the basic framework and work approaches and promote the construction process, based upon all the related data and information in this plant since 2008, we made clear the intension of base construction, six structural elements including technologies, services, pilot tests & technology popularization, technical training, skill appraisal, and culture system, according to which the corresponding six sub-bases were thus classified. In light of the present status, we put forward the following implementation proposals. (1) To build a base is not only a self-positioning and strategic objective, but a challenge and an opportunity for the plant. (2) Relevant standards, regulations and norms should be continuously compiled and promulgated to accumulate experiences for the standardized management of the plant and the standardized construction of new plants. (3) Technical and skilled talents should be constantly trained to strive for frontier leads and technological innovation, and in the state advocates of the integration of information and industrialization and "Made in China 2025", an intelligent purification plant should be constructed. (4) The overall inspection and maintenance service level should be enhanced to strengthen both soft and hard power of the training base. (5) The goal of "Factory Standardization, Talents Elite and Business Specialization" should be a driven force to achieve the great-leap-forward development and construction of a real purification base in China.

Number of references: 13

Main heading: Air purification

Controlled terms: Gas fuel purification - Gas industry - Gases - Natural gasoline plants - Sour gas

Uncontrolled terms: Base - Connotation - Implementation proposals - Structural elements - Symbol

Classification code: 512.2 Natural Gas Deposits - 513.2 Petroleum Refineries - 522 Gas Fuels - 643 Space Heating, Ventilation and Air Conditioning

DOI: 10.3787/j.issn.1000-0976.2019.01.017

Database: Compendex

6.

Accession number: 20194807752779

Title: **Kinetic mechanism of hydrophilic amino acid inhibiting the formation of tetrahydrofuran (THF) hydrate**

Title of translation: **亲水性氨基酸抑制四氢呋喃水合物形成的动力学机理**

Authors: Wang, Ren ; Li, Rui ; Zhang, Ling ; Sun, Jinsheng ; Sun, Huicui ; Shi, Xiaomei

Author affiliation: CNPC Engineering Technology R & D Company Limited, Beijing; 102206, China

Hubei Provincial Water Resources and Hydropower Planning Survey and Design Institute, Wuhan; Hubei; 430064, China

Faculty of Engineering, China University of Geosciences-Wuhan, Wuhan; Hubei; 430074, China

School of Petroleum Engineering, China University of Petroleum - East China, Qingdao; Shandong; 266580, China

Corresponding author: Sun, Jinsheng (sunjsdri@cnpc.com.cn)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: September 25, 2019

Publication year: 2019

Pages: 82-88

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Hydrophilic amino acid, as a new kind of hydrate inhibitor, is the hot spot of domestic and foreign relevant studies. At present, however, its intrinsic mechanism influencing the formation of hydrate is not figured out, and the understandings on its synergistic inhibition mechanism with other kinetic hydrate inhibitors (KHIs) are still controversial. In this paper, the influence laws of glycine, L-arginine and its combination with polyvinylpyrrolidone (PVP) on the formation of hydrate were clarified by experimentally simulating the formation of tetrahydrofuran (THF) hydrate, and the intrinsic mechanism was revealed by virtue of various experimental methods. And the following research results were obtained. First, glycine has such

a strong disturbance action on water molecules that it has stronger inhibition on the formation of hydrate. And when its dosage is 1.0%, its inhibition effect is the best. Second, L-arginine has a stronger binding action on water molecules, so it has stronger inhibition on the formation of hydrate. And in the range of lower dosages, its inhibition on the formation of hydrate increases gradually with the increase of its dosage. Third, the combination of hydrophilic amino acid and PVP has synergistic inhibition on the formation of hydrate. And the synergistic inhibition ability of combined glycine and PVP K90 is stronger when the total dosage of inhibitors is 1.0%. In conclusion, the research results provide experimental data and a theoretical basis for the research and development of new hydrate inhibitors.

Number of references: 28

Main heading: Hydration

Controlled terms: Amino acids - Arginine - Hydrates - Hydrophilicity - Mechanisms - Molecules - Organic solvents - Positive ions

Uncontrolled terms: Experimental methods - Hydrate inhibitors - Kinetic hydrate inhibitors - L-Arginine - Poly vinyl pyrrolidone - Research and development - Synergistic inhibition - Tetrahydrofuran hydrate

Classification code: 601.3 Mechanisms - 804.1 Organic Compounds - 931.3 Atomic and Molecular Physics

Numerical data indexing: Percentage 1.00e+00%

DOI: 10.3787/j.issn.1000-0976.2019.09.010

Database: Compendex

7.

Accession number: 20194807753806

Title: **On the security of natural gas supply in China**

Title of translation: **关于当前中国天然气供应安全问题的思考**

Authors: He, Runmin ; Li, Sensheng ; Cao, Qiang ; Zhou, Juan

Author affiliation: Natural Gas Economic Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 9

Issue date: September 25, 2019

Publication year: 2019

Pages: 123-131

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 22

Main heading: Gas supply

Controlled terms: Energy policy - Energy security - Gases - Natural gas - Security systems

Uncontrolled terms: Access security - China - Common security - Demand-side - Fishbone - Material safety - One Belt and One Road - Supply security

Classification code: 522 Gas Fuels - 525.6 Energy Policy - 914.1 Accidents and Accident Prevention

DOI: 10.3787/j.issn.1000-0976.2019.09.016

Database: Compendex

8.

Accession number: 20200408064867

Title: **A risk assessment method of wellbore instability based on the reliability theory**

Title of translation: **井壁失稳风险的可靠度理论评价方法**

Authors: Chen, Yingjie ; Deng, Chuanguang ; Ma, Tianshou

Author affiliation: Exploration Division, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: November 25, 2019

Publication year: 2019

Pages: 97-104

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Domestic and foreign scholars have carried out thorough studies on wellbore stability and have established a lot of empirical models, analytical models and numerical simulation methods. However, the uncertainty of input parameters and its effect on analysis result of wellbore stability are less researched and no clear understanding is obtained. In this paper, a risk assessment method of wellbore instability based on reliability theory was established on the basis of mechanical analytics model of wellbore stability, combined with First Order Second Moment method from reliability theory. By virtue of this method, the reliability probability of wellbore stability at different equivalent densities of drilling fluid was analyzed, and the influence of the uncertainty degree of parameters on the analysis result of wellbore stability was investigated. And the following research results were obtained. First, the distribution law of the input parameters of wellbore stability fits for normal distribution. As the variation coefficient increases, the uncertainty of the sampled data increases and its influence on the analysis results of wellbore stability get more significant. Second, as the equivalent density of drilling fluid increases, the probability of wellbore collapse decreases gradually and the probability of wellbore leakage increases gradually. An appropriate safety window can be confirmed at the intersection between reliability curves of wellbore collapse and fracture. Third, the influence of the uncertainty of different geological factors on the wellbore stability is ordered as: in-situ stress > pore pressure > rock strength. In conclusion, when wellbore stability is analyzed, it is necessary to determine the in situ stress accurately to reduce the influence of its uncertainty degree, so as to improve the accuracy of wellbore stability evaluation.

Number of references: 29

Main heading: Reliability theory

Controlled terms: Boreholes - Drilling fluids - Infill drilling - Method of moments - Normal distribution - Numerical methods - Oil field equipment - Reliability - Reliability analysis - Risk assessment - Stability - Stresses - Uncertainty analysis

Uncontrolled terms: Collapse pressure - Fracture pressures - Uncertainty - Variation coefficient - Wellbore stability

Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 914.1 Accidents and Accident Prevention - 921 Mathematics - 921.6 Numerical Methods - 922.1 Probability Theory - 922.2 Mathematical Statistics

DOI: 10.3787/j.issn.1000-0976.2019.11.013

Database: Compendex

9.

Accession number: 20193207284687

Title: **Seismic processing technologies for double complex structures in the Qiulitage structural belt, Tarim Basin**

Authors: Wu, Furong ; Guo, Haiyang ; Diao, Yongbo ; Song, Jisheng ; Xu, Yong ; Guo, Ran ; Yang, Fei ; Ou, Chang ; Liu, Huifen

Author affiliation: Southwest Geophysical Research Institute, BGP, CNPC, Chengdu; Sichuan; 610041, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 4

Issue date: April 25, 2019

Publication year: 2019

Pages: 28-36

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The Qiulitage structural belt, Tarim Basin, presents a great potential for hydrocarbon resources, but due to its complex ground surface, hinterland conditions and low signal-to-noise ratios (SNRs) of seismic data, further exploration there has been seriously affected. To this end, on the basis of high-precision

seismic data collection, we carried out seismic processing technologies especially for the double complex structure of the piedmont belt surface and ground belly, then formed a series of imaging techniques for pre-stack depth migration under very low SNR conditions, and finally carried out field application and effect analysis. The results show that: (1) The quality of 3D seismic data in the Qiulitage tectonic belt is significantly improved with the assistance of high-precision integrated static correction techniques, fidelity de-noising techniques under low SNR conditions, and pre-stack depth migration processing techniques for undulating surface. (2) It is clear that the Cretaceous and its underlying strata are of base-involved deformation, and slip along the top of the salt-salt or salt-mud layers of the Miocene Jidike Fm and the Palaeocene-Oligocene Kumglimu Group, where the ZQ and DQ structures are developed in the upper wall of F1 Fault while fault blocks in the lower wall of F1 Fault. (3) The ZQ ① structure and other 4 traps are confirmed, which covers a total area of 125 km. The trap area of the ZQ ① is 20 km with high reliability and risk exploration value. (4) In the deployed ZQ1 wildcat well, a major breakthrough was made in natural gas exploration in the Lower Cretaceous Bashijiqike Fm. In conclusion, the processing technology for double complex structure improves the accuracy of structure interpretation with a relative error of the main target zone being only 0.5%, which shows a good prospect of popularization and application to similar geological conditions. The Qiulitage structural belt has a great potential for gas exploration with a large area of many similar structures and traps to be explored.

Number of references: 15

Main heading: Signal to noise ratio

Controlled terms: Faulting - Geological surveys - Geophysical prospecting - Hydrocarbon refining - Imaging techniques - Natural gas wells - Petroleum prospecting - Seismic response - Seismic waves - Wildcat wells

Uncontrolled terms: High-steep structure - Low signal-to-noise ratio - Mountainous regions - Pre-stack depth migrations - Risk exploration - Tarim Basin - Tectonic belts

Classification code: 481.1 Geology - 481.4 Geophysical Prospecting - 484 Seismology - 512.1.2 Petroleum Deposits : Development Operations - 512.2.1 Natural Gas Fields - 513.1 Petroleum Refining, General - 716.1 Information Theory and Signal Processing - 746 Imaging Techniques

Numerical data indexing: Area 1.25e+08m2, Area 2.00e+07m2, Percentage 5.00e-01%

DOI: 10.3787/j.issn.1000-0976.2019.04.004

Database: Compendex

10.

Accession number: 20193907482169

Title: **Dynamic accumulation process of fault-translocation natural gas accumulation model: A case study on the gas reservoir of the second Member of Upper Triassic Xujiahe Fm in the Xinchang structural zone of the Western Sichuan Depression**

Title of translation: **断层输导型天然气成藏模式的动态成藏过程--以川西坳陷新场构造带上三叠统须二段气藏为例**

Authors: Zhang, Shihua ; Tian, Jun ; Ye, Sujuan ; Yang, Yingtao ; Fu, Ju

Author affiliation: Exploration and Development Research Institute, Sinopec Southwest Oil & Gas Company, Chengdu; Sichuan; 610041, China

Corresponding author: Tian, Jun (287582075@qq.com)

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Issue date: July 25, 2019

Publication year: 2019

Pages: 49-56

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The gas reservoir in the second Member of Upper Triassic Xujiahe Fm (Xu 2 Member) is an important exploration and development block of tight sandstone gas in the Western Sichuan Depression of the Sichuan Basin, but its gas and water distribution relationships are complex and its exploration and development is more difficult. In this paper, the Xu 2 Member gas reservoir in the Xinchang structural zone was taken as an example in order to provide a new idea for efficient exploration of the Xujiahe Fm gas reservoir in the Western Sichuan Depression. The effects of SN striking faults on the hydrocarbon accumulation and gas and water distribution in the Xu 2

Member gas reservoir were discussed based on the chemical characteristics of formation water, combined with the analysis on structures, fault translocation system characteristics and single-well production performance. And the following research results were obtained. First, high yield and enrichment area of Xu 2 Member gas reservoir in the Xinchang structural zone mainly presents a hydrocarbon accumulation pattern of fault-translocation type, which is good in structure-fault-reservoir configuration conditions and gas bearing property. Second, as for the hydrocarbon accumulation pattern of fault-translocation type, the factors controlling the high yield and enrichment of gas reservoir are "high positions of ancient and modern structures + fault translocation by connecting with the source + gas accumulation in high-quality reservoirs", and the key to control gas and water distribution is the spatial and temporal configuration of structure-fault-reservoir. Third, based on the difference of spatial and temporal configuration of structure-fault-fluid-diagenesis-accumulation, combined with single well production data, the hydrocarbon accumulation pattern of fault-translocation type is divided into 3 gas and water production characteristics, i.e., "high and stable gas production, gas and water production simultaneously", "medium and stable gas production, low water production" and "low gas production and high water production". Fourth, the wells with the production characteristics of "high and stable gas production, gas and water production simultaneous" present the characteristic that "faults and reservoirs are connected at structural highs", while the those with the production characteristics of "medium and stable gas production, low water production" present the characteristic that "faults and reservoirs are connected at structural highs and lows", which means that this kind of single well dominantly produces gas at a stable production rate with a little low-salinity formation water. Therefore, single well production can be improved by applying horizontal well drilling, so as to realize better economic benefits.

Number of references: 14

Main heading: Petroleum prospecting

Controlled terms: Chemical analysis - Gases - Horizontal drilling - Horizontal wells - Hydrocarbons - Oil bearing formations - Petroleum reservoirs - Produced Water - Quality control - Sandstone - Tight gas - Water supply systems - Well drilling

Uncontrolled terms: Hydrocarbon accumulation - Late Triassic - Sichuan Basin - Tight sandstone gas - Water distributions - Western Sichuan

Classification code: 446.1 Water Supply Systems - 482.2 Minerals - 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 804.1 Organic Compounds - 913.3 Quality Assurance and Control

DOI: 10.3787/j.issn.1000-0976.2019.07.006

Database: Compendex

11.

Accession number: 20193207285070

Title: **Dynamic mechanism of fluidic oscillation of a new friction reducing tool**

Authors: Tian, Jialin ; Yang, Yinglin ; Liming, Dai ; Song, Haolin ; Gong, Xuecheng ; Li, Jurui

Author affiliation: Key Laboratory of Oil and Gas Equipment, School of Mechanical Engineering, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Industrial Systems Engineering, University of Regina, Regina; SK; S4S0A2, Canada

CNOOC Offshore Oil Engineering <Qingdao> Co., Ltd., Qingdao; Shandong; 266520, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In the drilling process of horizontal section, the friction between the drill string and the borehole wall offsets partial weight on bit (WOB), so the WOB can be hardly transferred to the drilling bit, resulting in the decrease of the WOB transfer efficiency. In order to decrease the drilling friction and increase the drilling efficiency, we developed a new type of fluidic oscillation friction reducing tool (hereinafter "a new tool" for short) in this paper. Its dynamics and vibration antifriction characteristics were investigated. In addition, calculation example analysis and laboratory test were carried out, and their results were comparatively analyzed. And the following research results were

obtained. First, this new tool can generate the effect of fluidic oscillation and result in pulse pressure fluctuation, so that axial vibration is generated on the drill string and the friction between the drill string and the borehole wall is decreased. Second, in the actual working conditions, the fluctuation range of the drill bit speed increases and the occurrence possibility of the stick-slip phenomenon on the drill string decreases as the WOB and the rotating speed of the rotary table increase. Third, the vibration speed obtained by the example analysis and the experimental test presents obvious nonlinear laws, which can reflect the true vibration characteristics of the drill string. In conclusion, the coincidence between the example calculation and the experimental test result verifies the rationality of the new tool's structural design and the accuracy of the calculation result. This new tool can decrease the drilling friction of horizontal well effectively, and it can not only provide a technical support for the high-efficiency drilling of oil and gas wells, but also the theoretical reference for the development of oil and gas well drilling tools in new conditions.

Number of references: 25

Main heading: Oil well drilling

Controlled terms: Bits - Boreholes - Boring - Drill strings - Drilling - Drills - Efficiency - Friction - Horizontal drilling - Horizontal wells - Infill drilling - Natural gas wells - Oil field development - Slip forming - Stick-slip - Structural design - Vibration analysis

Uncontrolled terms: Antifriction characteristics - Dynamics and vibration - Experimental test - Fluidic oscillation - Oil and gas well drilling - Stick-slip phenomena - Vibration - Vibration characteristics

Classification code: 408.1 Structural Design, General - 412 Concrete - 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512 Petroleum and Related Deposits - 603.2 Machine Tool Accessories - 604.2 Machining Operations - 913.1 Production Engineering - 931.1 Mechanics

DOI: 10.3787/j.issn.1000-0976.2019.05.012

Database: Compendex

12.

Accession number: 20193607404655

Title: **Reservoir characteristics and main controlling factors of the Leikoupo gas pools in the western Sichuan Basin**

Authors: Xiao, Kaihua ; Li, Hongtao ; Duan, Yongming ; Zhang, Yan ; Liu,

Liping

Author affiliation: Key Laboratory for Marine Oil and Gas Exploitation, Sinopec Exploration & Production Research Institute, Beijing; 100083, China

Sinopec Southwest Oil & Gas Company, Chengdu; Sichuan; 610041, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

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ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Significant progress in natural gas exploration in the Middle Triassic Leikoupo Fm of the western Sichuan Basin have been achieved by Sinopec in recent years, and the western Sichuan gas field has become the key block for the increase of reserves and output of Sinopec in natural gas exploration and production in the 13th Five-Year Plan. For further understanding of the reservoir characteristics and the controlling factors of the Middle Triassic Leikoupo Fm reservoir in western Sichuan gas field, reservoir characteristics and the controlling factors of reservoir development in Shiyangchang-Jinma-Yazihe area were investigated based on detailed observation of rock slices and cores, utilizing porosity, permeability and intrusive mercury analysis in combination with well logging interpretation results. The research results show that: (1) the dolomite reservoirs of tidal flat facies were developed in the Leikoupo Fm of this area, which can be divided into an upper reservoir section, a lower reservoir section and an interlayer section; (2) the upper reservoir section is relatively simple in reservoir lithology, reservoir space type and pore-throat assemblage, and the main lithology is microcrystalline (crystal powder) dolomite with mainly pore-type reservoirs, and relatively high-quality microcrystalline dolomite reservoirs with medium porosity and low permeability are locally developed; (3) the lithology, reservoir space type and pore structure of the lower reservoir section are complex and strongly anisotropic, and the reservoirs are mainly of fracture-pore type with (extremely) low porosity

and permeability; (4) the reservoirs are vertically anisotropic, and different types of thin reservoirs are interbedded. The thickness of effective reservoirs is between 30 m and 56.6 m. The total thickness and overall physical properties of the the lower reservoir section is superior to the upper section; (5) the distribution of dolomite is controlled by the flat and algae flat microfacies as well as dolomitization, which lay a lithological foundation for reservoir development; (6) multi-stage quasi-syngenetic dissolution controlled by high-frequency intertidal cycles is the key factor for the development of high-quality reservoirs; (7) hydrocarbon filling during the burial stage inhibits the formation of scale cements, and makes the early-formed pores better preserved.

Number of references: 28

Main heading: Petroleum reservoir engineering

Controlled terms: Anisotropy - Crystal structure - Gas industry - Gases - Geological surveys - Lithology - Low permeability reservoirs - Natural gas - Natural gas fields - Pore structure - Porosity - Proven reserves - Quality control - Well logging

Uncontrolled terms: Controlling factors - Dolomite - Pore types - Reservoir characteristic - Sichuan Basin - Triassic - Western Sichuan

Classification code: 481.1 Geology - 512 Petroleum and Related Deposits - 522 Gas Fuels - 913.3 Quality Assurance and Control - 931.2 Physical Properties of Gases, Liquids and Solids - 933.1.1 Crystal Lattice

Numerical data indexing: Size 3.00e+01m to 5.66e+01m

DOI: 10.3787/j.issn.1000-0976.2019.06.004

Database: Compendex

13.

Accession number: 20193207285165

Title: **Establishment of an initial water production evaluation chart for the gas province in the East China Sea**

Authors: Lu, Kefeng ; Cai, Hua ; Wang, Li ; Shi, Meixue ; He, Xianke ; Fan, Hongjun

Author affiliation: Exploration & Development Research Institute, Shanghai Branch, CNOOC China Limited, Shanghai; 200335, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019
Pages: 63-70
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency

Abstract: In order to reveal the reasons for the differences in initial water production characteristics of gas wells in different regions of the East China Sea Basin and to screen favorable targets for low permeability reservoir reconstruction, we established a calculation method of initial production water-gas ratios at different gas column heights by combining gas-water two-phase capillary pressure with J function definition, power function relative permeability model and fractional flow equation. Then based on the experimental data of standard capillary pressure and standard relative permeability in the gas province of the East China Sea, an evaluation chart on initial production water-gas ratio of the East China Sea at different gas column heights was calculated and established. Finally, the evaluation chart was validated by using the data of the tested or commissioned gas wells in the gas reservoirs of the East China Sea, and the physical property conditions suitable for reservoir reconstruction of low-permeability gas reservoirs in the area of the East China Sea were determined according to the evaluation chart. And the following research results were obtained. First, the evaluation chart established in this paper reflects that the correlation between the parameters is similar to the actual production law and matches well with the actual data, which verifies the correctness and reliability of the chart establishment method and the key parameter calculation method. Second, with the production water-gas ratio less than 1 m/10m as the screening condition, for the permeability of the low permeability gas reservoirs (with gas column height of about 50 m) in the west subsag, the central uplift belt and the periphery suitable for reservoir reconstruction shall be greater than 0.65 mD, and that of the large low permeability gas reservoirs (with a gas column height of more than 100 m) in the north of central uplift belt shall be greater than 0.26 mD. Third, there is no gas-water contact in gas reservoirs under the hydrocarbon accumulation conditions of in-situ reservoirs, so the method and the evaluation chart proposed in this paper are not applicable. It is concluded that the method of establishing the initial water production evaluation chart and the method of calculating the

key parameters proposed in this paper can provide meaningful reference for the development and evaluation of other gas fields in China.

Number of references: 28

Main heading: Low permeability reservoirs

Controlled terms: Capillarity - Capillary tubes - Function evaluation - Gas industry - Gas permeability - Gases - Offshore gas fields - Offshore gas well production - Offshore gas wells - Parameter estimation - Petroleum reservoir evaluation

Uncontrolled terms: China - East China Sea - Evaluation charts - Gas reservoir - Parameter calculation - Relative permeability curves - Water-gas ratio

Classification code: 512 Petroleum and Related Deposits - 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 631.1 Fluid Flow, General - 921.6 Numerical Methods - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Size 1.00e+02m, Size 5.00e+01m

DOI: 10.3787/j.issn.1000-0976.2019.05.007

Database: Compendex

14.

Accession number: 20195107877697

Title: **Horizontal well fracturing stimulation technology for deep shale gas reservoirs**

Title of translation: **深层页岩气水平井储层压裂改造技术**

Authors: Shen, Cheng ; Guo, Xingwu ; Chen, Malin ; Yong, Rui ; Fan, Yu

Author affiliation: Shale Gas Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Chongqing Shale Gas Exploration and Development Co. Ltd., Chongqing; 401121, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Publication year: 2019

Pages: 68-75

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: There are huge shale gas resources in the deep reservoirs of southern Sichuan Basin, but due to their great burial depth and complex structures, the main technology of staged stimulated reservoir volume (SRV) suitable for the shallow shale gas reservoirs lower than 3 500 m is not applicable to the fracturing stimulation of deep shale gas reservoirs over 3 500 m and can hardly generate complex fracture networks. In this paper, a set of reservoir stimulation techniques based on horizontal well suitable for the shale gas reservoirs in deep complex structures were developed referring to the fracturing techniques used for the large-scale benefit development of shale gas above 3 500 m, combined with the structural and reservoir characteristics of deep shale. And they were applied on site to the fracturing stimulation of deep shale gas wells in the western Chongqing area. And the following research results were obtained. First, by virtue of the comprehensive natural fracture prediction technique, the natural fracture belts are characterized precisely and the development intensity of natural fractures is predicted quantitatively, so as to provide a basis for the optimization of subsequent fracturing operations. Second, among the parameters for evaluating the fracability of shale reservoir, the higher the brittleness index, fracture network propagation index and gas content index, the greater the reconstruction potential of reservoirs and the better the stimulation effect of gas wells. Third, the adoption of large-scale prepad fluid technique, "intense liquid injection, small number of perforations, and proppant injection of low-concentration slug type" technique and temporary plugging and diversion technique for improving the complexity of fracture networks increases single-well SRV and productivity effectively. In conclusion, the reservoir stimulation techniques developed in this paper are suitable for the fracturing stimulation of deep shale gas reservoirs and can be used as reference for the fracturing operations of similar shale gas wells.

Number of references: 18

Main heading: Fracture

Controlled terms: Complex networks - Energy resources - Fracture mechanics - Gases - Horizontal wells - Natural gas wells - Petroleum

reservoirs - Reservoirs (water) - Shale gas - Well stimulation

Uncontrolled terms: Chongqing - Deep layer - Horizontal well fracturing - Reservoir characteristic - Reservoir stimulations - Sichuan Basin - Stimulated reservoir volumes - Stimulation techniques

Classification code: 441.2 Reservoirs - 512.1.1 Oil Fields - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 525.1 Energy Resources and Renewable Energy Issues - 722 Computer Systems and Equipment - 931.1 Mechanics - 951 Materials Science

Numerical data indexing: Size 3.50e+03m

DOI: 10.3787/j.issn.1000-0976.2019.10.008

Database: Compendex

15.

Accession number: 20193907482180

Title: **Optimization technology for the plunger seal pair in fracturing pumps: Development and prospect**

Title of translation: **压裂泵柱塞密封副优化技术的发展与展望**

Authors: Wang, Guorong ; Liao, Daisheng ; He, Xia ; Zhong, Lin ; Li, Mengyuan ; Wei, Gang

Author affiliation: School of Mechanical Engineering, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Institute of Energy Equipment, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 73-80

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to break the bottleneck of the optimization technology

for the plunger seal pair in fracturing pumps, further improve the working performance of fracturing equipment and realize the increase of oil and gas production, we reviewed the research status on the failure of the plunger seal pair in fracturing pumps and summarized the existing optimization technologies for the plunger seal pair in fracturing pumps based on the actual working conditions and sealing mechanisms of fracturing pump plunger sealing system. On this basis, combined with the latest research achievements in the related fields (such as tribology and materials science), some suggestions and prospects on the future development of the optimization technology for the plunger seal pair in fracturing pumps in China were proposed. And the following research results were obtained. First, it has been proved that the surface texture technology can significantly reduce the friction and wear of plunger seal pair, and it is suggested to actively design and perform the full-size textured plunger sealing system test under the actual working condition of fracturing pumps so as to promote the application process of surface textured plunger. Second, in view of the short plank in the performance of rubber seal and the working requirements of fracturing pump plunger sealing system, it is in an urgent need to adopt the material modification technology to further enhance the comprehensive performance of sealing rubber. Third, the synergistic effect of surface texture technology, surface coating technology and material modification technology in anti-friction and anti-wear determines the feasibility and necessity of combining them into a new optimization technology for the plunger seal pair in fracturing pumps. And in the future, the practical application of this composite technology under the working conditions of fracturing pump shall be solved as soon as possible. It is concluded that the exploration and development status of oil and gas resources in China puts forward higher requirements for the working performance of fracturing equipment, and the plunger seal pair in fracturing pumps shall be optimized based on its own reality by learning from, digesting, absorbing and re-innovating the relevant theories and methods in the multi-disciplinary field, so as to form a new optimization technology for the plunger seal pair in fracturing pumps, which is in line with the actual situations in China.

Number of references: 63

Main heading: Seals

Controlled terms: Computer system recovery - Energy resources - Engineering education - Fracture - Friction - Oil field development - Oil field equipment - Petroleum prospecting - Pumps - Rubber - Textures - Tribology - Wear of materials

Uncontrolled Development - Fracturing pumps - Material modifications -

terms: Optimization technology - Plunger seal pair - Prospect - Reciprocating seals - Surface textures

Classification code: 511.2 Oil Field Equipment - 512.1.2 Petroleum Deposits : Development Operations - 525.1 Energy Resources and Renewable Energy Issues - 618.2 Pumps - 619.1.1 Pipe Accessories - 818.1 Natural Rubber - 901.2 Education - 931 Classical Physics; Quantum Theory; Relativity - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.07.009

Database: Compendex

16.

Accession number: 20194207561111

Title: **Migration rules of the deposited naphthalene particles in urban gas line pipes: A case study of Kunming, Yunnan**

Title of translation: **城市燃气管道内已沉积萘颗粒的运移规律**

Authors: Wu, Xiaonan ; Li, Qian ; Gou, Jiayuan ; Hu, Meilin ; Li, Zhao ; Liao, Hong

Author affiliation: School of Civil Engineering and Architecture, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

PetroChina Kunlun Gas Co., Ltd. - Yunnan, Kunming; Yunnan; 650200, China

Sales Company, Shunan Division of PetroChina Southwest Oil & Gasfield Company, Luzhou; Sichuan; 646000, China

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Pages: 104-112

Language: Chinese

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The manufactured gases containing such impurities as

naphthalene particles had been long used as urban gas, but they have been recently replaced by natural gas. The deposited naphthalene particles migrating along with the current gas flow will inevitably result in pipe blockage or damage to devices. In order to study the migration law of the deposited naphthalene particles in gas line pipes, we took the urban gas pipeline in Kunming as an example, adopted the RSM turbulence model and the DPM model of the Fluent software to simulate and analyze the migration law of the deposited naphthalene particles in horizontal straight pipes, horizontal bend pipes and tee pipes. And the influence of the deposited naphthalene particle size, inlet velocity, temperature and pressure on the migration of deposited naphthalene particles under different pipe diameters, curvature ratios and pipe diameter ratios were analyzed respectively. The results show that: (1) The migration rates of deposited naphthalene particles in the above three types of pipes are negatively correlated with the size of the deposited naphthalene particles, and are positively correlated with pressure and inlet velocity; (2) With the increase of temperature, the migration rate of naphthalene particles in the above three types of pipes decreases first and then increases; (3) The migration rate of naphthalene particles deposited in gas line pipes is most affected by the inlet velocity of gas flow, then by temperature and least by pressure. (4) The migration rate of naphthalene particles is positively correlated with the ratio of horizontal straight pipe diameter and tee pipe diameter, and negatively correlated with the ratio of horizontal bend pipe diameter. In conclusion, this study is of great significance in guaranteeing the safe operation of urban gas transportation and distribution system.

Number of references: 17

Main heading: Naphthalene

Controlled terms: Flow of gases - Gases - Inlet flow - Manufacture - Natural gas - Particle size - Particle size analysis - Piping systems - Turbulence models - Two phase flow - Urban transportation

Uncontrolled terms: Displacement - Gas lines - Gas solid two phase flow - Influence factor - Migration rates

Classification code: 432 Highway Transportation - 433 Railroad Transportation - 522 Gas Fuels - 537.1 Heat Treatment Processes - 619.1 Pipe, Piping and Pipelines - 631.1 Fluid Flow, General - 631.1.2 Gas Dynamics - 804.1 Organic Compounds - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.08.013

Database: Compendex

17.

Accession number: 20200408064788

Title: **A calculation method of compressor set efficiency at a natural gas filling station**

Title of translation: **天然气加气站压缩机组效率的计算方法**

Authors: Xu, Xiufen ; Li, Hongfei ; Liu, Guohao

Author affiliation: School of Mechanical Science and Engineering, Northeast Petroleum University, Daqing; Heilongjiang; 163318, China

Pipeline Technology Research Center, PetroChina Pipeline Co., Ltd., Langfang; Hebei; 065000, China

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: An electric-driven reciprocating compressor set is the main energy-consuming equipment of a natural gas filling station, and the efficiency of a compressor set is one of the key indicators in reasonably characterizing and scientifically evaluating the energy efficiency level of the gas filling station. As the general compressor set efficiency tests and calculation methods for a natural gas processing and transportation system is only applicable to the working conditions with constant compressor outlet pressure, but not to the working conditions of a gas filling station with real-time changes in compressor outlet pressure and temperature. In this regard, this paper developed a new method for calculating the compressor set efficiency at a natural gas filling station. According to the theory of thermodynamics, the total effective output energy of a compressor set is calculated using the enthalpy potential method, and the average efficiency of a compressor set at a gas filling station is calculated based on the ratio of total effective output energy to energy consumption of the compressor set. Then, this method was applied to a compressor set of a gas

filling station for field testing and calculation verification. And the following research results were obtained. First, the traditional theoretical method for calculating the efficiency of a compressor set at a gas filling station is relative accurate, but it is of poor operability and can be hardly operated during field testing. Second, the new method for calculating the average efficiency of a compressor set at a gas filling station is advantageous with fewer test parameters, simple calculation process and strong operability, and it is more suitable for field testing and engineering application. In conclusion, the relevant departments can apply this method to calculate and evaluate the energy efficiency level of a compressor set at a gas filling station. The research results provide a theoretical basis and technical support for formulating the efficiency improvement scheme of a gas filling station so as to accelerate the energy saving and consumption reduction work of gas filling stations.

Number of references: 20

Main heading: Filling stations

Controlled terms: Compressibility of gases - Energy efficiency - Energy utilization - Engineering research - Filling - Gases - Natural gas - Natural gas fields - Natural gas transportation - Neutron emission - Reciprocating compressors - Thermodynamics

Uncontrolled terms: Electric-driven reciprocating compressor set - Energy saving and consumption reductions - Field testing - Gas-filling station - REFPROP

Classification code: 512.2.1 Natural Gas Fields - 522 Gas Fuels - 525.2 Energy Conservation - 525.3 Energy Utilization - 618.1 Compressors - 641.1 Thermodynamics - 691.2 Materials Handling Methods - 901.3 Engineering Research - 931.2 Physical Properties of Gases, Liquids and Solids

DOI: 10.3787/j.issn.1000-0976.2019.11.014

Database: Compendex

18.

Accession number: 20194807752490

Title: **Progress and development direction of technologies for deep marine carbonate gas reservoirs in the Sichuan Basin**

Title of translation: **四川盆地深层海相碳酸盐岩气藏开发技术进展与发展方向**

Authors: Hu, Yong ; Peng, Xian ; Li, Qian ; Li, Longxin ; Hu, Die

Author affiliation: PetroChina Southwest Oil & Gasfield Company, Chengdu;

Sichuan; 610051, China

Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Corresponding author: Li, Qian (liqian05@petrochina.com.cn)

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Pages: 48-57

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In recent years, deep marine carbonate gas reservoirs has become an important field in increasing conventional gas reserves and production in the Sichuan Basin. Due to complex hydrocarbon accumulation conditions, great burial depth and complicate gas-water relation, however, this type of gas reservoirs faces huge challenges to realize efficient development. In this paper, the development history of deep marine carbonate gas reservoirs in the Sichuan Basin was analyzed. Then, based on such development characteristics and practices, special technologies were summarized. Finally, the research direction for the coming years was pointed out. And the following research results were obtained. First, the reserves of the deep marine carbonate gas reservoirs in the Sichuan Basin vary greatly in scales and types. The reservoirs are of poor quality and strong heterogeneity with active edge and bottom water. The raw gas generally contains acidic gas. What's more, most development wells are located in mountainous areas, and drilled formations are complicated in vertical distribution. Second, special technologies have been formed in the Sichuan Basin, including the fine description technology for strong-heterogeneity gas reservoirs in deep low-gentle structures, the optimized water control technology for the water-bearing gas reservoirs with developed small-scale fractures and vugs, drilling, completion and stimulation engineering technologies for deep complicated gas wells, and the support technology for clean and safe development of sulfur-bearing gas reservoirs, so as to

provide support for the efficient productivity construction and optimized development of giant marine carbonate reservoirs in the Sichuan Basin. Third, as the development of the carbonate gas reservoirs in the Sichuan Basin begins to convert into the gas reservoirs in ultra-deep complex structures, the next direction of technological research is the fine structure description and thin reservoir prediction technique, across-scale numerical simulation technique, drilling and completion and gas production engineering technique for deep marine carbonate gas reservoirs. It is concluded that these special technologies for the efficient development of deep marine carbonate gas reservoirs provides powerful support for the PetroChina Southwest Company to build up giant gas fields with the reserves of tens of billions of cubic meters and realize the leaping growth of gas production. The research results can provide valuable technical reference for the development of deep marine carbonate gas reservoirs at home and abroad.

Number of references: 32

Main heading: Petroleum reservoirs

Controlled terms: Bearings (machine parts) - Carbonation - Gas engineering - Gas industry - Gases - Infill drilling - Natural gas well completion - Natural gas well production - Proven reserves - Well stimulation

Uncontrolled terms: Deep - Engineering techniques - Gas reservoir - Gas reservoir description - Marine carbonate rock - Sichuan Basin - Water control

Classification code: 511.1 Oil Field Production Operations - 512 Petroleum and Related Deposits - 522 Gas Fuels - 601.2 Machine Components - 802.2 Chemical Reactions

DOI: 10.3787/j.issn.1000-0976.2019.09.006

Database: Compendex

19.

Accession number: 20193607404665

Title: **A characteristic analysis between acidolysis gas and absorbed gas and its application to gas-source correlation in Mao 1 Member, Fuling area, Sichuan Basin**

Authors: Yao, Wei ; Xu, Jin ; Xia, Wenqian ; Wang, Qiang ; Rao, Dan ; Chen, Qianglu

Author affiliation: Wuxi Research Institute of Petroleum Geology, Sinopec Exploration & Production Research Institute, Wuxi; Jiangsu; 214126, China

Sinopec Exploration Company, Chengdu; Sichuan; 610041, China

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Pages: 45-50

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The acidolysis gas in source rocks is the desorbed hydrocarbon gas in non-connected pores and carbonate crystal lattice, while the absorbed gas lies in the connected pores and is absorbed by surface. It is controversial about whether to use absorbed gas or acidolysis gas in gassource correlation. Using the absorbed gas and acidolysis gas in the first member of the Middle Permian Maokou Fm (hereinafter referred to as Mao 1 member) of Fuling area in the Sichuan Basin, the differences of components and carbon isotopes between absorbed gas and acidolysis gas and their applicable conditions in gas-source correlation were discussed. The results show that: (1) there are larger differences of components and isotopes between absorbed gas and acidolysis gas. The absorbed gas has more heavy hydrocarbons and heavier carbon isotope. This difference can be attributed to the easier diffusion of methane and light hydrocarbons in absorbed gas, leading to relatively enriched heavy hydrocarbons and heavier carbon isotope in absorbed gas; (2) acidolysis gas is a mixture of hydrocarbon gas formed during different stages, while absorbed gas is the result of equilibrium between diffusion and supply of hydrocarbon gas, which can result in the differences on carbon isotope sequences between them; (3) the characteristics of natural gas produced after acid fracturing in the Mao 1 member in Fuling area resembles those of acidolysis gas in source rocks, while the characteristics of natural gas produced without acid fracturing are more similar to those of adsorbed gas; (4) the natural gas pool of the Mao 1 member is a carbonate gas pool with self-generation and self-storage. It is concluded that for the gas pool formed after migration, its producing pays have not been processed by acid fracturing, the produced gas should be correlated with the adsorbed gas in

source rocks; for the carbonate gas pool with self-generation and self-storage, acid fracturing is usually needed, and the produced gas should be correlated with the acidolysis gas in source rocks.

Number of references: 16

Main heading: Fracturing (fossil fuel deposits)

Controlled terms: Carbon - Carbonation - Gases - Hydrocarbons - Isotopes - Lakes - Natural gas - Rocks

Uncontrolled terms: Acidolysis - Adsorbed gas - Carbon isotopes - Component - Fuling area - Gas pool - Gas-source correlations - Permian - Self-generation - Sichuan Basin

Classification code: 511.1 Oil Field Production Operations - 522 Gas Fuels - 802.2 Chemical Reactions - 804 Chemical Products Generally - 804.1 Organic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.06.005

Database: Compendex

20.

Accession number: 20200208027865

Title: **Connectivity of pores in shale reservoirs and its implications for the development of shale gas: A case study of the Lower Silurian Longmaxi Formation in the southern Sichuan Basin**

Title of translation: **页岩气储层孔隙连通性及其对页岩气开发的启示--以四川盆地南部下志留统龙马溪组为例**

Authors: Zhang, Haijie ; Jiang, Yuqiang ; Zhou, Keming ; Fu, Yonghong ; Zhong, Zheng ; Zhang, Xuemei ; Qi, Lin ; Wang, Zhanlei ; Jiang, Zengzheng

Author affiliation: Chongqing Shale Gas Exploration and Development Co., Ltd., Chongqing; 401147, China

School of Geosciences and Technology, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Reservoir Evaluation Branch, PetroChina Unconventional Key Laboratory, Chengdu; Sichuan; 610500, China

Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 401147, China

Sichuan Kehong Petroleum and Natural Gas Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

Geological Exploration and Development Research Institute, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu;

Sichuan; 610051, China

Sichuan Geosience Resource and Technology Co., Ltd., Chengdu; Sichuan; 610213, China

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Abstract: The unconnected gas-bearing pores in shale gas reservoirs may be transformed into "potential recoverable pores" after large-scale hydraulic fracturing. However, the mainstream pore classification methods of shale gas reservoirs, do not take the unconnected pores into account, which impacts the evaluation accuracy of reservoir pore effectiveness. To solve this problem, this paper took the shale of Lower Silurian Longmaxi Formation in the southern Sichuan Basin as the research object to carry out experiments on core porosity, centrifugal + gradual drying NMR after saturated with brine and NMR freeze-thaw using plunger samples and fragmented samples to analyze the volume, main development location and main pore size distribution range of unconnected pores. Then, the pore systems were classified, and the lower limit of effective pore size of connected gas-bearing pores was determined. Finally, the total pore effectiveness of shale gas reservoirs was evaluated, and the influence of unconnected pores on the development of shale gas was discussed. And the following research results were obtained. First, there are a large number of unconnected pores in the shale gas reservoirs of the study area, accounting for 30.23%. Most of them are mainly developed in organic matters and a few are developed in clay minerals. The distribution of pore size ranges from 5 nm to 30 nm. Second, T2 cut-off value of clay bound water in the shale gas reservoirs of the study area is 0.26 ms, whose corresponding pore size is 5.35 nm, which is the lower limit of the effective pore size. Third, large-scale hydraulic fracturing can improve the unconnected pores with the size more than 5.35 nm, so effective development of shale gas will be realized. Fourth, after hydraulic fracturing stimulation, the

unconnected pores can increase the storage space of fracturing fluid in the matrix, absorb the fracturing fluid in the fractures, replace the shale gas in the pores and promote the automatic alleviation of water lock in shale gas reservoirs, so the single-well shale gas production will be increased. In conclusion, fluid occurrence and pore system in shale pores can be quantitatively divided by means of centrifugal + gradual temperature drying method combined with NMR experiments, movable water and capillary bound water can be determined by the high speed centrifugal + NMR experiments, and capillary bound water and clay bound water can be determined by the gradual drying + NMR experiments.

Number of references: 35

Main heading: Oil bearing formations

Controlled terms: Centrifugation - Classification (of information) - Drying - Fracturing fluids - Gas bearings - Gases - Hydraulic fracturing - Locks (fasteners) - Nuclear magnetic resonance spectroscopy - Organic minerals - Petroleum reservoir evaluation - Petroleum reservoirs - Pore size - Shale gas - Well stimulation

Uncontrolled terms: Bound waters - Pore effectiveness - Pore system - Shale gas reservoirs - Sichuan Basin - Unconnected pore - Water locks

Classification code: 482.2 Minerals - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 601.2 Machine Components - 716.1 Information Theory and Signal Processing - 802.3 Chemical Operations - 951 Materials Science

Numerical data indexing: Percentage 3.02e+01%, Size 5.00e-09m to 3.00e-08m, Size 5.35e-09m, Time 2.60e-04s

DOI: 10.3787/j.issn.1000-0976.2019.12.003

Database: Compendex

21.

Accession number: 20200408065010

Title: **Main controlling factors of enrichment and high-yield of deep shale gas in the Luzhou Block, southern Sichuan Basin**

Title of translation: **泸州区块深层页岩气富集高产主控因素**

Authors: Yang, Hongzhi ; Zhao, Shengxian ; Liu, Yong ; Wu, Wei ; Xia, Ziqiang ; Wu, Tianpeng ; Luo, Chao ; Fan, Tianyou ; Yu, Linyao

Author affiliation: PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Shale Gas Research Institute of PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Shunan Division, PetroChina Southwest Oil & Gasfield Company, Luzhou; Sichuan; 646001, China

Sichuan Shale Gas Co., Ltd., Chengdu; Sichuan; 610051, China

Corresponding author: Zhao, Shengxian (zhaoshengxian@petrochina.com.cn)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The key to the scale development of deep shale gas lies in a better understanding of the main controlling factors for its enrichment and high-yield. In this regard, the high-quality shale of the Upper Ordovician Wufeng-Longmaxi Formations in the Luzhou Block, southern Sichuan Basin, was taken as the research object. Based on drilling, logging, seismic and analytical test data of a typical core well there, an in-depth study was conducted on the tectonic, sedimentary, and reservoir characteristics and compressibility of shale in this study area. On this basis, combined with production performance, the main controlling factors of a high-yield shale gas well were discussed. The following findings were achieved. (1) There are two sets of type-I reservoirs with high gas saturation, high total gas content and high brittle mineral content vertically. One is S1l11 sub-layers with a thickness of 10-20 m, the other is S1l11 sub-layer with a thickness of 3-10 m. (2) The thicker the type-I reservoir, the longer the targeted horizontal sections, and the higher initial production rate of a horizontal shale gas well. Under the same scenario, the trial test production rate of a shale gas well in the Luzhou Block is 10-25% higher than that in the Changning and Weiyuan blocks. (3) The deep shelf sedimentary center controls the distribution of high-quality shale in the Luzhou Block, and under the setting of low deep structure and abnormally high pressure, those well-developed high-angle natural fractures are

good for the accumulation of free gas, and due to a high brittle material content there, the complex fracture networks are easily formed by fracturing, as a result, a high yield will be easily achieved for a shale gas well in this study area. In conclusion, high-yield and enrichment of shale gas reservoirs should be under such favorable conditions as being located in the deep-water shelf sedimentary center and with well-developed high-angle natural fractures under the setting of low steep structure and abnormally high pressure.

Number of references: 26

Main heading: Oil field equipment

Controlled terms: Fracture - Gases - High pressure engineering - Horizontal wells - Offshore gas fields - Offshore gas well production - Offshore gas wells - Petroleum reservoirs - Quality control - Sedimentology - Shale gas

Uncontrolled terms: Deep - High yield - Luzhou Block - Natural fracture - Sichuan Basin

Classification code: 481.1 Geology - 511.2 Oil Field Equipment - 512.1.1 Oil Fields - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 913.3 Quality Assurance and Control - 951 Materials Science

Numerical data indexing: Percentage 1.00e+01% to 2.50e+01%, Size 1.00e+01m to 2.00e+01m, Size 3.00e+00m to 1.00e+01m

DOI: 10.3787/j.issn.1000-0976.2019.11.007

Database: Compendex

22.

Accession number: 20193207285080

Title: **Mechanisms and prevention & control countermeasures of water breakthrough in horizontal wells in multi-layer unconsolidated sandstone gas reservoirs: A case study of the Tainan Gas Field in the Qaidam Basin**

Authors: Yang, Yun ; Gu, Duanyang ; Lian, Yunxiao ; Liu, Guoliang ; Han, Shengmei ; Chang, Lin ; Ma, Yuankun ; Zhang, Yongnian

Author affiliation: Exploration and Development Research Institute, PetroChina Qinghai Oilfield Company, Dunhuang; Gansu; 736202, China

No.1 Gas Production Plant, PetroChina Qinghai Oilfield Company, Dunhuang; Gansu; 736202, China

Corresponding author: Gu, Duanyang (gudyqh@petrochina.com.cn)

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Publication year: 2019

Pages: 85-92

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Water breakthrough in horizontal wells is now the main factor restricting the stable production of the Tainan Gas Field in the Qaidam Basin. In view of this problem, the distribution characteristics of irreducible water saturation were investigated by using the nuclear magnetic resonance logging interpretation technology. And combined with the production situations of the horizontal wells in Tainan Gas Field in the initial stage of their production, the characteristic parameters of the reservoir which produced the intrastratal water as soon as it was put into production were determined. Then, the factors influencing the production of irreducible water were studied by means of gas drive water core experiments, and the factors influencing the sealing ability of the interbeds were researched by conducting mudstone breakdown tests. What's more, the effects on the bottom hole pressure by the length of horizontal section at different daily gas productions were investigated through numerical simulation. Finally, the prevention & control countermeasures for water breakthrough in horizontal wells were proposed. And the following research results were obtained. First, the horizontal well which drills into the reservoir with mobile water saturation higher than 7.2% and gas saturation lower than 63.5% produces formation water in its initial stage of production. Second, the lower the shale content is and the greater the production pressure difference is, the more favorable it is for the production of irreducible water. The production of irreducible water in the reservoirs with stronger areal heterogeneity is a continuous process. Third, the sealing capacity of the interbed increases with the decrease of its vertical permeability and water saturation and with the increase of its shale content and thickness. Fourth, the breakthrough pressure of type I mudstone (shale content>90%) is about 4 MPa, that of type II mudstone (80%<shale content<90%) is about 2 MPa, and that of type III mudstone (60%<shale content<80%) is about 1.5 MPa. In conclusion, the edge water

encroachment can be delayed and the water-free gas production period of gas well can be extended by increasing the length of horizontal section and controlling the production pressure difference. It is recommended to carry out balanced gas production in horizontal wells in the initial stage of production, enhance dynamic monitoring in the process of production, and drain the water in time in the case of water breakthrough so as to increase its cumulative gas production.

Number of references: 21

Main heading: Horizontal wells

Controlled terms: Bottom hole pressure - Gas industry - Gases - Mechanical permeability - Natural gas well production - Nuclear magnetic logging - Petroleum reservoir engineering - Petroleum reservoirs - Radioactivity logging - Shale

Uncontrolled terms: Breakthrough pressures - Gas fields - Heterogeneous reservoirs - Interbed - Irreducible water saturation - Qaidam basin - Water breakthrough

Classification code: 481.4 Geophysical Prospecting - 512 Petroleum and Related Deposits - 522 Gas Fuels

Numerical data indexing: Percentage 6.35e+01%, Percentage 7.20e+00%, Pressure 1.50e+06Pa, Pressure 2.00e+06Pa, Pressure 4.00e+06Pa

DOI: 10.3787/j.issn.1000-0976.2019.05.010

Database: Compendex

23.

Accession number: 20200208027980

Title: **Sedimentary characteristics of Lower and Middle Cambrian diamict in the northwestern Tarim Basin**

Title of translation: **塔里木盆地西北部中下寒武统混积岩沉积特征**

Authors: Bai, Ying ; Xu, Anna ; Liu, Wei ; Zhao, Zhenyu ; Luo, Ping

Author affiliation: PetroChina Research Institute of Petroleum Exploration & Development, Beijing; 100083, China

Corresponding author: Xu, Anna (xan@petrochina.com.cn)

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Language: Chinese

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Recently, Well Ketan 1 in the Keping area of the Tarim Basin achieved an industrial gas flow from the diamict of Wusonggeer Formation, Lower and Middle Cambrian, which breaks through the "restricted zone" of diamict exploration. So far, however, the sedimentary characteristics and oil and gas exploration potential of the diamict in this area have not been understood clearly. In order to promote further study on the Cambrian diamict in the whole basin and the evaluation on oil and gas exploration potential, this paper took the massive diamict of Shayilike-Wusonggeer Formations, Lower and Middle Cambrian in the Akesu outcrop next to the Keping area as the research object. Based on the previous research results on regional structures, sedimentary facies and reservoirs, combined with the data of outcrop observation, thin section analysis and geochemical analysis, the sedimentary facies of Wusonggeer-Shayilike Formations were analyzed using a combination method of sequence stratigraphy, petrology and sedimentation-microfacies study. Then, the oil and gas exploration potential of the diamict in this area was evaluated. And the following research results were obtained. First, sedimentary environments of Lower and Middle Cambrian in the Akesu outcrop area are mainly evaporative platform, semi-restricted platform and neritic shelf, including 19 diamict lithofacies, 3 carbonate lithofacies, and 2 clastic lithofacies. Besides, 5 types of microfacies assemblages are recognized, including 4 types of reservoirs with low to ultralow porosity and permeability. In addition, high-quality reservoirs are developed in regional intervals. Second, the sedimentary environments of Lower and Middle Cambrian in the Akesu area experience a transition process from open to close and then sallification, including 3 major sedimentary structural layers, i.e., gentle slope of carbonate rock, restricted platform of evaporite and diamict, and restricted platform of evaporite. And the development mode of the diamict in the restricted platform of evaporite and diamict is controlled by the property and the location of provenance, the condition and the change rate of climate, the depth and the temperature of evaporative gypsum-salt lake water body, the paleogeomorphology of platform basin, and the interface change rate of different levels of

sequences. Third, gypsum-salt bearing dolomitic mudstone with higher total organic content (TOC) and mudstone of tidal flat facies, which are the potential source rocks, are developed in the massive diamict of Lower and Middle Cambrian in the Akesu area. And among them, the source-reservoir-caprock assemblages of Wusonggeer-Shayilike diamict are better in configuration, and their oil and gas exploration potential shall not be ignored.

Number of references: 17

Main heading: Petroleum prospecting

Controlled terms: Analytical geochemistry - Climate change - Flow of gases - Gases - Gasoline - Geological surveys - Gypsum - Low permeability reservoirs - Petroleum reservoir engineering - Petrology - Phase interfaces - Salt deposits - Sedimentary rocks - Sedimentology - Stratigraphy

Uncontrolled terms: Cambrians - Diamict - Oil and gas exploration potential - Reservoir-caprock assemblage - Sedimentary characteristics - Sedimentary micro-facies - Sequence stratigraphy - Tarim Basin

Classification code: 443.1 Atmospheric Properties - 481.1 Geology - 481.1.2 Petrology (Before 1993, use code 482) - 482.2 Minerals - 505.1 Nonmetallic Mines - 512.1 Petroleum Deposits - 512.1.2 Petroleum Deposits : Development Operations - 523 Liquid Fuels - 631.1.2 Gas Dynamics - 801 Chemistry - 801.4 Physical Chemistry

DOI: 10.3787/j.issn.1000-0976.2019.12.006

Database: Compendex

24.

Accession number: 20200208027836

Title: **Analysis of and countermeasure for bit failures in heterogeneous strata based on vibration measurement**

Title of translation: **基于振动实测的非均质地层钻头失效分析与对策**

Authors: Kong, Hua ; Lan, Kai ; Liu, Xiangfeng ; Liu, Mingguo ; Chao, Wenxue ; Xi, Liuming

Author affiliation: Drilling Engineering Technology Research Institute, Sinopec Zhongyuan Oilfield Service Corporation, Puyang; Henan; 457001, China

Tarim Drilling Company, Sinopec Zhongyuan Oilfield Service Corporation, Korla; Xinjiang; 841000, China

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Language: Chinese

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In the Sichuan Basin, an important area of shale gas development in China, the rate of penetration (ROP) has been improved after constant researches and practices in recent years. Under the effect of geological factors of complex harsh strata (e.g. poor drillability and strong heterogeneity), however, the improper vibration of a downhole drilling string system is violent and serious bit damage and low ROP tend to occur easily, so the drilling time efficiency will be seriously impacted. In order to solve these problems, this paper took the Upper Permian Longtan Formation-Middle Permian Maokou Formation in the Fuling working area of the Sichuan Basin as an example. The dynamic vibration acceleration parameters of a drilling bit-string system were measured using the high-frequency downhole vibration measurement tool. Then, combined with the analysis on the lithology and the mineral component of the strata, the causes of and countermeasures for bit failures were studied. Finally, field experiments were carried out. And the following research results were obtained. First, in drilling the heterogeneous strata, the drilling bit-string system generates a high-amplitude instantaneous shock vibration greater than 40 m/s, which is just the main reason for early bit failures. Second, the "vibration damping + pressure boost" drilling assembly is recommended for inhibiting the high-amplitude instantaneous shock vibration, so are the drilling parameters for avoiding tool resonance. Third, compared with a neighboring well, the test well adopting the new drilling parameters is 17% lower in the high-amplitude instantaneous shock and 24% higher in the single-bit footage. And thus the operation environment of the drilling bit is improved and the number of used drilling bits is decreased. In conclusion, the research results can effectively improve the vibration state of a drilling bit-string system and is conducive to reaching the target of extending the service life of

a drilling bit.

Number of references: 20

Main heading: Vibration analysis

Controlled terms: Bits - Damping - Failure (mechanical) - Infill drilling - Lithology - Vibration measurement

Uncontrolled terms: Critical speed - Drillability - Drilling bit - Heterogeneity - Shock - Sichuan Basin - Vibration acceleration - Vibration-damping

Classification code: 481.1 Geology - 511.1 Oil Field Production Operations - 603.2 Machine Tool Accessories - 931.1 Mechanics - 943.2 Mechanical Variables Measurements

Numerical data indexing: Acceleration 4.00e+01m/s2, Percentage 1.70e+01%, Percentage 2.40e+01%

DOI: 10.3787/j.issn.1000-0976.2019.12.014

Database: Compendex

25.

Accession number: 20194807752968

Title: **Effect of impact loads on the micro-nanopore structure of anthracite coal**

Title of translation: **冲击荷载对无烟煤微纳观孔隙结构的影响**

Authors: Wang, Yixian ; Liang, Weimin

Author affiliation: School of Civil Engineering, Henan Polytechnic University, Jiaozuo; Henan; 454000, China

Henan Technical College of Construction, Zhengzhou; Henan; 450064, China

Corresponding author: Liang, Weimin (liangwm@hpu.edu.cn)

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Abbreviated source title: Natur. Gas Ind.

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Pages: 73-81

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: To clarify the effect of impact loads on the micro-nanopore structure of anthracite coal, this paper acquired coal samples from the coal mining face of No.2 Zhaogu coal mine of the Jiaozuo Mining Field, Henan Province. After the samples were prepared, the shock wave and stress wave are simulated using the shock loading system of split Hopkinson pressure bar (SHPB). Then, the effect of impact load on the micro-nanopore structure of anthracite coal was discussed by carrying out impact tests, combined with the test results of mercury injection and low-temperature liquid nitrogen experiments on the coal samples before and after the impact. And the following research results were obtained. First, after impact loading, the total pore volume, specific surface area, porosity and mercury extrusion efficiency of anthracite coal increase in a fluctuating manner. On the whole, the number of pores is increased and the connectivity is improved significantly. Second, the impact loads in different directions have different transformation effects on the coal pores. The impact loads vertical to the bedding mainly increase the number of micropores and macropores, those parallel to the bedding mainly increase the number of micropores and transition pores, and those oblique to the bedding mainly increase the number of mesopores and macropores. Third, the optimal impact load is different in different directions. The optimal impact load which is vertical, parallel and oblique to the bedding is 42.10 MPa, 20.45 MPa and 56.90 MPa, respectively. In conclusion, the transformation effects of the impact loads on the pores in anthracite coal are all around, but due to their different directions from the bedding, their actual pore transformation ranges in different directions are different.

Number of references: 34

Main heading: Anthracite

Controlled terms: Coal mines - Liquefied gases - Liquid nitrogen - Mercury (metal) - Microporosity - Nanopores - Shock waves - Stress analysis - Temperature

Uncontrolled terms: Impact loads - Low temperatures - Mercury injection - Pore transformations - SHPB - Split Hopkinson pressure bars - Total pore volume - Transformation effects

Classification code: 503.1 Coal Mines - 524 Solid Fuels - 549.3 Nonferrous Metals and Alloys excluding Alkali and Alkaline Earth Metals - 641.1 Thermodynamics - 761 Nanotechnology - 804.2 Inorganic

Compounds - 931 Classical Physics; Quantum Theory; Relativity - 931.2 Physical Properties of Gases, Liquids and Solids - 933 Solid State Physics - 951 Materials Science

Numerical data indexing: Pressure 2.04e+07Pa, Pressure 4.21e+07Pa, Pressure 5.69e+07Pa

DOI: 10.3787/j.issn.1000-0976.2019.09.009

Database: Compendex

26.

Accession number: 20193907482166

Title: **Reservoir characteristics and their controlling factors of the fourth Member of Upper Sinian Dengying Fm in the northern Sichuan Basin**

Title of translation: **四川盆地北部上震旦统灯影组四段储层特征及其控制因素**

Authors: Duan, Jinbao ; Dai, Lincheng ; Li, Bisong ; Zhu, Xiang ; Li, Hui

Author affiliation: Sinopec Exploration Company, Chengdu; Sichuan; 610041, China

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Publication year: 2019

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The researches on the reservoir characteristics and development laws of the fourth Member of Dengying Fm, Upper Sinian in the northern Sichuan Basin, are mostly speculations based on the sedimentary models of the Dengying Fm in the whole basin, combined with regional geological setting, and no agreement has been reached in terms of reservoir development laws and their controlling factors. In order to provide the support for the oil and gas exploration in the northern Sichuan Basin, we studied the reservoir characteristics and distribution laws of the fourth

Member of Dengying Fm using cores, conventional and casting thin sections, physical property and mercury intrusion data, and then we analyzed the reservoir development models of the fourth Member of Dengying Fm and their controlling factors and compared those in the central Sichuan Basin. And the following research results were obtained. First, in the northern Sichuan Basin, the types of reservoir rocks in the fourth Member of Dengying Fm are mainly algae clotted dolomite, algae stromatolitic dolomite, algae clastic dolomite and doloarenite, the reservoir space is mainly acted by algae framework pores and intragranular dissolution pores, and reservoir types include vuggy reservoir of bioherm core facies, fractured-porous reservoir of bioherm flat facies and porous reservoir of shallow facies. Second, reservoirs are mainly developed in the middle and upper parts of each submember of the fourth Member of Dengying Fm. There is dominantly the porous reservoir of shallow facies in the first submember, and the vuggy reservoir of bioherm core facies and the fractured-porous reservoir of bioherm flat facies in the second submember. Third, the reservoirs in the fourth Member of Dengying Fm are mainly under the control of sedimentary facies and diagenesis. The microfacies of bioherm core, grain beach and bioherm flat are favorable for the development of reservoirs, karstification and recrystallization are favorable for the formation of pores, and the karstification in the early diagenesis period is the key factor for the large-scale increase of pores in the reservoirs of bioherm beach facies. Fourth, the formation and evolution of the reservoirs in the fourth Member of Dengying Fm can be divided into 4 stages, i.e., the formation of primary pores in the sedimentation-syngenesis-penecontemporaneous period, the reduction of primary pores in the shallow burial period, the large-scale formation of secondary pores in the early diagenesis period, and the modification of secondary pores in middle-deep burial period. Fifth, the comparison between the reservoir of the fourth Member of Dengying Fm in the northern Sichuan Basin and that in the central Sichuan Basin shows that they are similar but their controlling factors are different. The former is a facies-controlled reservoir and the latter is controlled by sedimentary facies and karstification. In conclusion, the Langzhong-Yuanba-Guangyuan-Hujiaba area is the most favorable area for the reservoir development of the fourth Member of Dengying Fm in the northern Sichuan Basin, and the Nanjiang-Bazhong area is a relatively favorable area.

Number of references: 21

Main heading: Reefs

Controlled terms: Algae - Beaches - Petroleum prospecting - Sedimentology

Uncontrolled Bioherm beach facies - Control factors - Dengying Period -

terms: Favorable exploration area - Karstification - Late Sinian - Reservoir characteristic - Sichuan Basin

Classification code: 407.3 Coastal Engineering - 481.1 Geology - 512.1.2 Petroleum Deposits : Development Operations

DOI: 10.3787/j.issn.1000-0976.2019.07.002

Database: Compendex

27.

Accession number: 20193907482164

Title: **Fracturing technologies of deep shale gas horizontal wells in the Weirong Block, southern Sichuan Basin**

Title of translation: **四川盆地威荣区块深层页岩气水平井压裂改造工艺**

Authors: Cao, Xuejun ; Wang, Minggui ; Kang, Jie ; Wang, Shaohong ; Liang, Ying

Author affiliation: Sinopec Southwest Petroleum Engineering Co., Ltd., Deyang; Sichuan; 618000, China

Engineering Technology Research Institute of Southwest Oil & Gasfield Branch of Sinopec, Deyang; Sichuan; 618000, China

Corresponding author: Wang, Minggui (771248454@qq.com)

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Publication year: 2019

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Language: Chinese

ISSN: 10000976

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Stimulation of hydraulic fracturing of horizontal shale gas wells in the Weirong Block has always been facing many difficulties due to many factors such as complicated geological conditions, small differences between the horizontal principal stress and the vertical principal stress, high working pump pressures, and low

sensitive sand ratios. In view of this, by combing the geological structure, engineering geological characteristics and the difficulties of fracturing of deep shale gas wells in the Weirong Block, learning from the general idea of volumetric fracturing for shale gas reservoirs at home and abroad, we determined the main ideas and technical countermeasures for fracturing in the area and applied them to the subsequent fracturing practices of shale gas wells. And the following achievements were obtained. First, the conventional fracturing technology applied to the shale gas wells in the Weirong Block resulted in low fracture complexity, small stimulated reservoir volume (SRV), difficulties in guaranteeing the effectiveness of perforation clusters, low strength of proppant adding, difficulties in obtaining higher conductivity, poor stable production capacity after stimulation, and difficulties in meeting the need of well fracturing with casing deformation. Second, in view of the difficulties of fracturing stimulation in deep shale gas wells of the Weirong Block, super high pressure, huge displacement, large fluid volume, steering temporary plugging in fracturing, and variable displacement technology can effectively increase SRV and the complexity of fractures in distant wells. The effectiveness of multi-cluster perforation can be guaranteed by comprehensive utilization of multi-cluster perforation optimization technology, big displacement technology and steering temporary plugging & fracturing technology at slots. The continuous proppant-adding technology with large displacement, high viscosity, low sand ratio, low density and small particle size can improve sand adding strength and fracture conductivity. Besides, the stimulation technology for casing deformed wells using coiled tubing fast processing + small diameter bridge plug and separate pumping technology of perforating gun have been formed. Third, after the above fracturing technologies have been applied in five shale gas horizontal wells in the Weirong Block, the average absolute open flow(QAOF)reached 26.11×10 m/d, indicating a good stimulation effect. In conclusion, this paper can provide meaningful reference for the development of deep shale gas wells of the similar type.

Number of references: 19

Main heading: Well perforation

Controlled terms: Coiled tubing - Deformation - Engineering education - Fracture - Gases - Geology - Horizontal wells - Natural gas well production - Natural gas wells - Particle size - Petroleum reservoirs - Proppants - Shale gas - Well stimulation

Uncontrolled terms: Casing deformation - Complex stress - Shale gas reservoirs - Sichuan Basin - Weirong Block

Classification 481.1 Geology - 511.1 Oil Field Production Operations - 512.1.1

code: Oil Fields - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 901.2 Education - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.07.010

Database: Compendex

28.

Accession number: 20193207285062

Title: **Key technologies of additional impressed current cathodic protection for in-service gas pipeline networks**

Authors: Cen, Kang ; Wang, Lei ; Sun, Huafeng ; Han, Tao ; Wang, Fei

Author affiliation: School of Civil Engineering and Architecture, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Chengdu Gas Transmission Operation Area, Gas Transmission Division, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610066, China

Pipeline Management Department, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 20

Main heading: Pipelines

Controlled terms: Anodes - Cathodic protection - Corrosion resistant coatings - Electric grounding - Electric power supplies to apparatus - Electric power systems - Feeding - Flanges - Groundwater - Insulation - Pipeline corrosion - Pressure regulators -

Program debugging - Site selection - Underground equipment - Water levels

Uncontrolled terms: Deep wells - Electrical continuity - Feeding tests - Gas pipeline networks - Impressed current - Protection zones

Classification code: 413 Insulating Materials - 444.2 Groundwater - 539.2 Corrosion Protection - 619.1 Pipe, Piping and Pipelines - 619.1.1 Pipe Accessories - 691.2 Materials Handling Methods - 706.1 Electric Power Systems - 714.1 Electron Tubes - 723.1 Computer Programming - 732.1 Control Equipment

Numerical data indexing: Electrical_Resistance 4.00e+05Ohms

DOI: 10.3787/j.issn.1000-0976.2019.05.014

Database: Compendex

29.

Accession number: 20195107877744

Title: **Mechanisms of casing damage during shale gas well fracturing treatment**

Title of translation: **页岩气井压裂过程中套管损坏的机理**

Authors: Zhang, Zhi ; Liu, Jinming ; Liu, Hexing ; Li, Lei ; Zhao, Yuanjin ; Ding, Jian ; Yang, Kun ; Song, Chuang

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

CNOOC China Limited Zhanjiang Branch, Zhanjiang; Guangdong; 524057, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 27

Main heading: Thermal expansion

Controlled terms: Boreholes - Expansion - Fracturing (fossil fuel deposits) - Fracturing fluids - Heat transfer - Natural gas wells - Oil field equipment - Shale gas - Temperature

Uncontrolled terms: Casing damage - Large displacements - Local traps - Steel grades - Wall thickness

Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 641.1 Thermodynamics - 641.2 Heat Transfer - 951 Materials Science

Numerical data indexing: Time 1.80e+03s

DOI: 10.3787/j.issn.1000-0976.2019.10.010

Database: Compendex

30.

Accession number: 20193207284500

Title: **A comprehensive extraction enhancement technology of reducing leakage and improving permeability in low-permeability coal seams**

Authors: Pan, Jingtao

Author affiliation: CCTEG Shenyang Research Institute, Shenyang; Liaoning; 110016, China

State Key Laboratory of Coal Mine Safety Technology, Fushun; Liaoning; 113122, China

Corresponding author: Pan, Jingtao (163tao@163.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 4

Issue date: April 25, 2019

Publication year: 2019

Pages: 55-61

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 18

Main heading: Extraction

Controlled terms: Blasting - Boreholes - Carbon dioxide - Coal - Coal bed methane - Coal deposits - Coal industry - Coal mines - Firedamp - Hydrocarbon seepage - Mechanical permeability - Methane - Sealing (finishing) - Seals

Uncontrolled terms: Enhancement technologies - Gas extractions - Low permeability coal seam - Permeability improvements - Phase Change - Wall types

Classification code: 503 Mines and Mining, Coal - 503.1 Coal Mines - 522 Gas Fuels - 524 Solid Fuels - 619.1.1 Pipe Accessories - 802.3 Chemical Operations - 804.1 Organic Compounds - 804.2 Inorganic Compounds

Numerical data indexing: Size 1.20e+01m, Size 3.00e+00m, Size 4.00e+00m

DOI: 10.3787/j.issn.1000-0976.2019.04.007

Database: Compendex

31.

Accession number: 20200408064926

Title: **Effect of gas-liquid ratio on the performance of hydrocyclones for desanding flowback fracturing fluids**

Title of translation: **气液比对压裂返排液旋流除砂器性能的影响**

Authors: Liu, Peikun ; Wang, Huajian ; Zhao, Zhenjiang ; Li, Luncao ; Xiao, Xiaolong ; Zhang, Hua ; Liu, Bing

Author affiliation: College of Mechanical and Electronic Engineering, Shandong University of Science and Technology, Qingdao; Shandong; 266590, China

Key Laboratory of Oilfield Produced Water Treatment and Environmental Pollution Enterprises, Dongying; Shandong; 257026, China

Corresponding author: Liu, Bing (skdpaper2008@163.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Issue date: November 25, 2019
Publication year: 2019
Pages: 44-54
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency
Number of references: 28
Main heading: Air
Controlled terms: Cyclone separators - Energy dissipation - Flow fields - Fracturing fluids - Liquids - Multiphase flow - Particle size - Separation - Velocity distribution - Vortex flow
Uncontrolled terms: Desanding - Flowback - Gas-liquid ratio - Hydro-cyclone - Optimal design
Classification code: 525.4 Energy Losses (industrial and residential) - 631.1 Fluid Flow, General - 802.1 Chemical Plants and Equipment - 802.3 Chemical Operations - 804 Chemical Products Generally - 922.2 Mathematical Statistics
Numerical data indexing: Percentage 1.00e+01% to 2.00e+01%, Percentage 3.00e+01%, Percentage 3.00e+01% to 4.00e+01%, Percentage 4.00e+01%
DOI: 10.3787/j.issn.1000-0976.2019.11.006
Database: Compendex

32.

Accession number: 20200208027948

Title: **Electro-flocculation pretreatment experiments of shale gas drilling wastewater**

Title of translation: **页岩气钻井废水电絮凝预处理实验**

Authors: Zhang, Hua ; Luo, Zhen ; Zhang, Xiaofei ; Liu, Yiyang ; Chen, Yingchun

Author affiliation: State Key Laboratory of Petroleum Pollution Control, Beijing; 102206, China

CNPC Research Institute of Safety and Environmental Technology, Beijing; 102206, China

Chongqing Division of PetroChina Southwest Oil & Gasfield Company, Chongqing; 400011, China

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Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 12

Issue date: December 25, 2019

Publication year: 2019

Pages: 146-154

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 26

Main heading: Chemicals removal (water treatment)

Controlled terms: Biogeochemistry - Biological materials - Chemical analysis - Chemical bonds - Coagulation - Current density - Flocculation - Hardness - Infill drilling - Metal ions - Organic compounds - Ostwald ripening - Reaction rates - Shale gas - Turbidity - Ultrafiltration - Wastewater treatment

Uncontrolled terms: Chemical coagulations - Comparative analysis - Conjugated double bonds - Flocculation process - High current densities - Organic matter removal - Pre-Treatment - Short reaction time

Classification code: 452.4 Industrial Wastes Treatment and Disposal - 461.2 Biological Materials and Tissue Engineering - 511.1 Oil Field Production Operations - 522 Gas Fuels - 531.1 Metallurgy - 701.1 Electricity: Basic Concepts and Phenomena - 741.1 Light/Optics - 801.2 Biochemistry - 801.4 Physical Chemistry - 802.2 Chemical Reactions - 802.3 Chemical Operations - 803 Chemical Agents and Basic Industrial Chemicals - 804 Chemical Products Generally - 804.1 Organic Compounds - 951 Materials Science

Numerical data indexing: Percentage 5.34e+01%, Percentage 6.27e+01%, Percentage 9.83e+01%, Time 1.20e+03s, Time 6.00e+02s

DOI: 10.3787/j.issn.1000-0976.2019.12.019

Database: Compendex

33.

Accession number: 20200208027944

Title: **A breakthrough in high-yield horizontal gas wells and great exploration and development potential in deep conventional gas reservoirs in the Sichuan Basin**

Title of translation: **高产水平井的突破与四川盆地深层常规气藏巨大的勘探开发潜力**

Authors: Zhang, Benjian ; Fang, Jin ; Yin, Hong ; Yang, Hua ; Yang, Xun ; Wang, Yufeng ; Pei, Senqi ; Hu, Xin ; Li, Rongrong ; Sun, Zhiyun ; Wang, Qiang ; Yin, Hanxiang

Author affiliation: Northeast Sichuan Division of PetroChina Southwest Oil & Gasfield Company, Jiangyou; Sichuan; 621741, China

Southwest Petroleum University, Chengdu; Sichuan; 610051, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: December 25, 2019

Publication year: 2019

Pages: 1-9

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: There is a huge potential of natural gas resources in deep marine carbonate gas reservoirs in the northwestern Sichuan Basin, where the structural-lithological Middle Permian Qixia Formation gas reservoirs in the Shuangyushi structure are characterized by ultra depth, ultra high temperature and ultra high pressure. Due to the effect of beach body development, diagenesis and tectonism, the reservoirs in this area are of strong heterogeneity and the tested single-well gas production rate varies greatly. In order to improve natural gas exploration and development benefit and realize "sparse well and high yield", we comprehensively analyzed the key factors influencing the enrichment and high yield of natural gas in Qixia Formation gas reservoirs in this area through core analysis, logging and seismic data. Then, based on 3D seismic data, the "complex wave" and "weak wave peak" in the seismic profile of Qixia Formation were depicted precisely and the areal distribution

laws of quality reservoirs in the gas reservoirs were figured out. Meanwhile, with new technologies having been thoroughly applied in this study area, two implemented horizontal wells (SYX131 and SYX133) have been drilled into thick dolomite reservoirs with their tested daily natural gas production rates of Qixia Formation being 123.97×10 m and 142.51×10 m, respectively, which set up a new record of high-yield gas rate there. And the following research results were obtained. First, natural gas productivity in this area is in obvious positive correlation with the thickness of dissolved pore type and dissolved cavern type dolomite reservoirs of Qixia Formation and the fracture development degree. Second, the seismic profile presents the reflection characteristics of "complex wave" at the top of Qixia Formation and "weak wave peak" in the middle and upper parts. The more developed the reservoirs, the more obvious the characteristic of "complex wave" or "weak wave peak". Third, such new technologies as horizontal-well drilling, large-scale open-hole staged acidizing stimulation, are important engineering support in this study area. In conclusion, such a breakthrough made in these two high-yield horizontal wells demonstrated that there is a huge potential in the deep marine carbonate gas reservoirs of northwestern Sichuan Basin.

Number of references: 17

Main heading: Natural gas well logging

Controlled terms: Carbonation - Energy resources - Gases - Geophysical prospecting - Horizontal drilling - Horizontal wells - Infill drilling - Lithology - Natural gas - Natural gas well production - Natural gas wells - Petroleum prospecting - Petroleum reservoirs - Seismic response - Seismic waves - Well drilling - Well stimulation

Uncontrolled terms: Dolomite reservoirs - Gas reservoir - High yield - High-temperature and high-pressure gas reservoirs - Permian - Sichuan Basin

Classification code: 481.1 Geology - 481.4 Geophysical Prospecting - 484 Seismology - 484.2 Secondary Earthquake Effects - 511.1 Oil Field Production Operations - 512 Petroleum and Related Deposits - 522 Gas Fuels - 525.1 Energy Resources and Renewable Energy Issues - 802.2 Chemical Reactions

DOI: 10.3787/j.issn.1000-0976.2019.12.001

Database: Compendex

34.

Accession number: 20193207284516

Title: **Fracture geometry near the wellbore of a horizontal well with in-plane perforation**

Authors: Sun, Feng ; Tang, Meirong ; Zhang, Xiang ; Li, Chuan ; Xue, Shifeng

Author affiliation: College of Pipeline and Civil Engineering, China University of Petroleum <East China>, Qingdao; Shandong; 266580, China

Oil and Gas Technology Institute, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710021, China

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Issue date: April 25, 2019

Publication year: 2019

Pages: 62-68

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The in-plane perforation is a new type of well completion method for the stimulated reservoir volume (SRV) of tight oil and gas reservoirs. Previously, however, the regulatory effects of perforation on fracture initiation position and fracture geometry near the wellbore were less studied, the spatial position of each channel of in-plane perforation was simplified as a plane, and the effects of the angle parameters of in-plane perforation on the fracturing pressure of a horizontal well and the fracture geometry near the wellbore were neglected. In order to make up for these shortcomings, a near-wellbore fracture mechanics model in the form of hydro-mechanical coupling was established in this paper. Then, local 3D fracture initiation position and geometric change of shots were characterized by using the fracture element based on continuous damage mechanics, and the finite-element numerical solving program of a coupling model was developed to investigate fracture initiation and propagation laws. Finally, the effects of perforation angle and departure angle on the initial fracturing pressure and fracture initiation position were analyzed quantitatively based on the actual perforation completion parameters of horizontal wells in the Changqing Oilfield. What's more, the fracture geometry near the wellbore of horizontal wells with in-plane perforation was compared with that with helical perforation. And the

following research results were obtained. First, the fracturing pressure and fracture initiation position of the horizontal wells with controllable perforation vary with perforation angle and departure angle. The fracturing pressure of channel varies greatly, and fracture initiation occurs at different positions, e.g. the perforation-wellbore interface and the middle part of the channel. The in-plane perforator shall control the departure angle in the range of 15°-30°. Second, by changing the jet direction of channels, in-plane perforation increases the stress interference between the channels, so as to reduce the fracturing pressure of horizontal wells by 2.0-3.5 MPa. Third, the in-plane perforation can guide and control the fracture strike near the wellbore, so as to produce the initial fracture plane perpendicular to the wellbore of horizontal wells and avoid the distortion of near-wellbore fractures caused by helical perforation. In this way, the completion degree of the fracture the system near the wellbore of a horizontal well is improved. In conclusion, the near-wellbore fracture mechanics model established in this paper can simulate the perforation and near-wellbore dynamic fracture process of a horizontal well, and its calculation results are better accordant with the field test data.

Number of references: 25

Main heading: Horizontal wells

Controlled terms: Boreholes - Computer simulation - Fracture mechanics - Geometry - Natural gas well completion - Oil field equipment - Oil well completion - Oil wells - Petroleum reservoir engineering - Petroleum reservoirs - Pressure - Well perforation

Uncontrolled terms: Fracture geometries - Fracturing pressure - Hydromechanical coupling - Near wellbore - Tight oil and gas reservoirs

Classification code: 511.2 Oil Field Equipment - 512 Petroleum and Related Deposits - 723.5 Computer Applications - 921 Mathematics - 931.1 Mechanics

Numerical data indexing: Pressure 2.00e+06Pa to 3.50e+06Pa

DOI: 10.3787/j.issn.1000-0976.2019.04.008

Database: Compendex

35.

Accession number: 20192607106214

Title: **Effect of temperature drop after throttling on the verification accuracy of large-flow natural gas metering and**

countermeasures

Title of translation: 节流降温对天然气大流量计量检定准确性的影响与对策

Authors: You, Yun ; Li, Lin ; Duan, Jiayi

Author affiliation: School of Petroleum Engineering, Chongqing University of Science and Technology, Chongqing; 401331, China

CCTEG Chongqing Engineering Co., Ltd., Chongqing; 400016, China

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Issue date: February 25, 2019

Publication year: 2019

Pages: 111-116

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to meet the verification requirements, it is necessary to carry out comprehensive adjustment on the flow rate, pressure and temperature of incoming medium at large-flow natural gas metering stations. As a result, however, the standard representation value is distorted due to the temperature drop after throttling and the unstable temperature of gas source. In this paper, the verification process and gas source conditions of typical large-flow natural gas metering stations were analyzed. Then, the influences of temperature change on the physical properties of the verification medium and the thermal deformation of the verification pipeline were studied, and the verification error caused by the temperature drop was calculated. Finally, the gas source was reheated so as to eliminate the influence of the measurement error caused by temperature drop after throttling of the verification medium. And the following research results were obtained. First, temperature change can affect the change of natural gas density, and the temperature drop of medium by 1℃ will bring about 0.045% error to the verification result. Second, temperature change can affect the thermal deformation of the verification pipeline, and the temperature drop of medium by 4℃ will result in a relative error of 0.01%. Third, the measurement error of the metering instruments can be

effectively reduced by adopting specifically a natural gas reheating process which combines electric heat tracing pipeline and heating furnace together. In conclusion, the influence of the temperature drop of verification medium on the accurate evaluation of the measurement results shall not be ignored. It is necessary to further explore the law of the horizontal changes in volume and take the natural gas reheating process that can accurately control temperature change, so as to improve the stability and accuracy of the measurement process of natural gas trade.

Number of references: 18

Main heading: Natural gas transportation

Controlled terms: Deformation - Density of gases - Drops - Gas meters - Gases - Industrial heating - Measurement errors - Natural gas - Pipelines

Uncontrolled terms: Flow metering - Process system - Reheating process - Temperature drops - Thermal deformation

Classification code: 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 642.1 Process Heating - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Percentage 1.00e-02%, Percentage 4.50e-02%

DOI: 10.3787/j.issn.1000-0976.2019.02.015

Database: Compendex

36.

Accession number: 20192607089029

Title: **Breakthrough in natural gas exploration in the platform margin shoal at the Maokou Fm in the Yuanba area, Sichuan Basin, and its implications**

Title of translation: **四川盆地元坝地区茅口组台缘浅滩天然气勘探的突破与启示**

Authors: Hu, Dongfeng

Author affiliation: Sinopec Exploration Company, Chengdu; Sichuan; 610041, China

Corresponding author: Hu, Dongfeng (hudf.ktnf@sinopec.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Issue date: March 25, 2019
Publication year: 2019
Pages: 1-10
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency

Abstract: In 2018, Well Yuanba 7 drilled into the platform margin shoal reservoir of the Middle Permian Maokou Fm in the Yuanba area of the Sichuan Basin and a high-yield industrial gas flow was obtained, indicating a great breakthrough of oil and gas exploration in the new field of high-energy platform marginal facies belt of the Maokou Fm in the Sichuan Basin. In order to deepen the geological understanding on the Maokou Fm, this paper analyzed the regional tectonic movement. Then, the lithology, thickness, paleogeomorphology and seismic reflection structure of the Maokou Fm were studied by means of petrology and mineralogy based on fine seismic interpretation results, and the distribution of sedimentary facies was defined. Finally, the reservoir characteristics and control factors of the Maokou Fm were researched by means of core observation, thin section analysis, SEM analysis and physical property analysis. What's more, the origins and sources of natural gas, the characteristics of caprocks and the main control factors of hydrocarbon accumulation in the Maokou Fm were preliminarily determined. And the following research results were obtained. First, due to the effect of the Emei taphrogenic movement in the late Maokou period, the sedimentary facies belt of carbonate platform margin–slope–continental shelf is developed in the Yuanba area, and two types of reservoirs are developed at the platform margin, i.e., high-energy shoal carbonate and sedimentary tuff. Second, the development of Maokou Fm reservoir is mainly under the joint control of platform marginal facies belt, exposed dissolution, the Dongwu movement uplift and volcanic ash sedimentary alteration. Third, in the Sichuan basin, marine carbonate rocks have great exploration potential of natural gas, and the platform marginal facies belt is a favorable area for the development of large- and medium-sized gas fields. In conclusion, strengthening geological research and innovating geological cognition are the foundation of exploration breakthrough, and developing key seismic exploration technology for reservoir identification is the guarantee of efficient exploration.

Number of references: 22

Main heading: Petroleum prospecting

Controlled terms: Carbonation - Flow of gases - Gases - Geological surveys - Lithology - Minerals - Natural gas - Natural gas fields - Oil well drilling - Petroleum reservoirs - Sedimentology - Seismic prospecting - Seismology - Volcanoes

Uncontrolled terms: Lithologic gas reservoir - Permian - Platform margins - Reservoir characteristic - Reservoir-forming condition - Sichuan Basin - Yuanba areas

Classification code: 481.1 Geology - 482.2 Minerals - 484 Seismology - 484.1 Earthquake Measurements and Analysis - 512 Petroleum and Related Deposits - 522 Gas Fuels - 631.1.2 Gas Dynamics - 802.2 Chemical Reactions

DOI: 10.3787/j.issn.1000-0976.2019.03.001

Database: Compendex

37.

Accession number: 20194207561138

Title: **Separate layer fracturing and multi-layer production of tight sandstone gas reservoirs in the Sulige Gas Field, Ordos Basin: Problems and countermeasures**

Title of translation: **苏里格气田致密砂岩气藏多层分压开采面临的难题及对策**

Authors: Li, Xianwen ; Xiao, Yuanxiang ; Chen, Baochun ; Shen, Yunbo ; Wen, Xiaoyong ; Zhou, Changjing ; Shi, Hua ; Jin, Fuguang

Author affiliation: National Engineering Laboratory of Low-Permeability Oil & Gas Exploration and Development, Xi'an; Shaanxi; 710018, China

Oil and Gas Technology Institute, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710018, China

Development Department, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710018, China

Corresponding author: Xiao, Yuanxiang (xiaoyx_cq@petrochina.com.cn)

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Publication year: 2019

Pages: 66-73

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In the Sulige Gas Field of the Ordos Basin, many sets of gas-bearing strata are developed, such as Permian Shanxi Formation and Shihezi Formation, and they are typical tight sandstone gas reservoirs with the characteristics of multiple layers in one well, low single-layer production, strong lateral heterogeneity, low permeability, low pressure and low abundance. After years' exploration and development, the geological conditions in the Sulige Gas Field are understood better and better, and the innovative development of processes and technologies and the continuous improvement of technical ideas promote scale production. With the continuous advance of exploration and development, however, the reservoir conditions become more complex, which brings new challenges to the efficiency increase and cost reduction of separate layer fracturing and multi-layer production technology. In this paper, the development history of separate layer fracturing and multi-layer continuous production technology in the Sulige Gas Field was reviewed, and the understandings and enlightenments obtained from the researches were analyzed and summarized. It is indicated that the existing separate layer fracturing technology consisting of two main parts (i.e., mechanical packer and casing sliding sleeve) is the key technology for the economic and efficient development of the Sulige Gas Field. It doubles the efficiency of fracturing operation, presenting a good application effect. Then, the technical challenges facing the Sulige Gas Field during its development were summarized as follows. Multi-layer production is insufficient, the drilling technologies cannot guarantee the benefit development in the whole life cycle of gas wells, and the separate layer fracturing technology can hardly give considerations to the congruent development of Upper Paleozoic and Lower Paleozoic. Finally, combined with the development situations of Sulige Gas Field, the countermeasures to above mentioned difficulties and the development direction of the separate layer fracturing and multi-layer production technology suitable for gas reservoirs were discussed as follows. First, strengthen the researches on well pattern matching and improve the reserves producing degree and the ultimate recovery factor. Second, select the layers to be transformed, optimize the separate layer fracturing technology, and improve the development benefit of multi-layer production. Third, optimize drilling and production technologies systematically, and establish a new efficiency increase and cost reduction model

for the whole life cycle of slim holes. Fourth, research the separate layer fracturing and commingled production technology suitable for Upper and Lower Paleozoic reservoirs, so as to satisfy the congruent development of Upper and Lower Paleozoic gas reservoirs.

Number of references: 15

Main heading: Low permeability reservoirs

Controlled terms: Boreholes - Coiled tubing - Cost reduction - Economic and social effects - Efficiency - Fracture - Gas industry - Gases - Infill drilling - Life cycle - Metamorphic rocks - Natural gas well production - Oil bearing formations - Pattern matching - Petroleum prospecting - Petroleum reservoir engineering - Sandstone - Separation - Tight gas

Uncontrolled terms: Ordos Basin - Sliding sleeves - Slim hole - Sulige gas field - Technical countermeasures - Well patterns

Classification code: 482.2 Minerals - 511.1 Oil Field Production Operations - 512 Petroleum and Related Deposits - 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 802.3 Chemical Operations - 913.1 Production Engineering - 951 Materials Science - 971 Social Sciences

DOI: 10.3787/j.issn.1000-0976.2019.08.008

Database: Compendex

38.

Accession number: 20193907482174

Title: **Physical simulation experiments on pore evolution in high-temperature and overpressure reservoirs**

Title of translation: **高温超压储层孔隙演化的物理模拟实验**

Authors: You, Li ; Qu, Xiyu ; Zhong, Jia ; Li, Cai ; Wu, Shijiu ; Gao, Yuan ; Cui, Jinggang

Author affiliation: CNOOC China Limited Zhanjiang Branch, Zhanjiang; Guangdong; 524057, China

China University of Petroleum - East China, Qingdao; Shandong; 266580, China

Taizhou Oil Production Plant, Sinopec East China Company, Taizhou; Jiangsu; 225300, China

Central Laboratory, PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 21-30

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: At present, simulation on reservoir evolution under normal pressure is common while that under abnormal pressure is rare. In this paper, the Miocene "high-temperature and overpressure" reservoir in the Ledong-Lingshui Sag of the Qiongdongnan Basin was taken as the research object to quantitatively define the effects of high pressure and overpressure on the evolution of reservoir pores. After the temperature and pressure field in this area was divided in the setting of sedimentation and diagenesis, the evolution characteristics of pores in different temperature and pressure field were analyzed by means of natural analogy and physical simulation experiment. Then, the effects of overpressure and fluids on the evolution of reservoir pores were discussed. Finally, the main factors controlling the development of high-quality reservoirs were determined. And the following research results were obtained. First, the temperature and pressure field of the Miocene reservoir in the Ledong-Lingshui Sag can be divided into three zones, i.e., high temperature and normal pressure zone, high temperature and overpressure zone, and high temperature and super overpressure zone. Second, overpressure and super overpressure can provide some preservation on primary pores. In the same diagenetic stage, the plane porosity of overpressure and super overpressure reservoirs is 1.23%-6.74% higher than that of normal pressure reservoirs. Once the reservoir pressure in overpressure and super overpressure areas is higher than hydrostatic pressure by 8 MPa and 4 MPa, respectively, about 1% primary pores are preserved. Third, the dissolution of organic acid makes greater contribution to the secondary pores in reservoirs and its plane porosity is 0.96%-7.38% higher than that of normal compacted reservoirs. Fourth, the leaching effect of meteorological water on reservoir physical properties is slight, and its plane porosity is only 0.19% higher than that of normal compacted reservoirs. In conclusion, the dissolution of organic acid is the most constructive effect for the reservoirs in high

temperature and normal pressure. In addition, preservation of primary pores by overpressure is the most constructive effect for the reservoirs in high temperature and (super) overpressure, and the higher the overpressure is, the more preservation effect it provides on pores.

Number of references: 21

Main heading: Reservoirs (water)

Controlled terms: Dissolution - High pressure effects - Hydrostatic pressure - Organic acids - Porosity - Quality control

Uncontrolled terms: Control factors - Ledong-Lingshui Sag - Miocene - Overpressure - Pore evolution - Qiongdongnan basin - Secondary pores

Classification code: 441.2 Reservoirs - 631.1.1 Liquid Dynamics - 802.3 Chemical Operations - 804.1 Organic Compounds - 913.3 Quality Assurance and Control - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Percentage 1.00e+00%, Percentage 1.23e+00% to 6.74e+00%, Percentage 1.90e-01%, Percentage 9.60e-01% to 7.38e+00%, Pressure 4.00e+06Pa, Pressure 8.00e+06Pa

DOI: 10.3787/j.issn.1000-0976.2019.07.003

Database: Compendex

39.

Accession number: 20195107877746

Title: **Development characteristics of concretions in the Longmaxi Formation of Lower Silurian in the Sichuan Basin and the indicating significance of their depositional environment**

Title of translation: **四川盆地下志留统龙马溪组结核体发育特征及其沉积环境意义**

Authors: Wang, Yuman ; Li, Xinjing ; Wang, Hao ; Chen, Bo ; Jiang, Shan ; Ma, Jie ; Dai, Bing

Author affiliation: PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

Yangtze University, Wuhan; Hubei; 430100, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: So far, the development characteristics of concretions in the Longmaxi Formation of Lower Silurian and the indicating significance of their depositional environment of black shale have been rarely studied. In this paper, the GR, rock mineral, thin section, organic geochemistry and other data were analyzed. Then, based on the outcrop and drilling data of the southern-eastern Sichuan Depression and its periphery, combined with the research results on the geological characteristics of the adjacent rocks (e.g. lithofacies, geochemistry and electrical property), the development characteristics of concretions in the Longmaxi Formation were explored and the indicating significance of their depositional environment was revealed. And the following research results were obtained. First, the occurrence horizons and lithofacies characteristics of concretions in the Longmaxi Formation are regionally different. In the southern and southeastern Sichuan Depression, the concretionary layers develop in the Coronograptus cyphus and Demirastrites triangulatus graptolite belts, and their lithofacies is dominated by calcareous-siliceous mixed shale facies, calcareous-argillaceous mixed shale facies, argillaceous-siliceous mixed shale facies and calcareous shale facies. In the Eastern Sichuan-Western Hubei Depression, the concretionary layers develop in the Demirastrites triangulatus and Lituigrapatus convolutus graptolite belts, and their lithofacies is dominated by argillaceous-siliceous mixed shale facies, siliceous shale facies and calcareous-siliceous mixed shale facies. Second, the GR curves of these concretionary layers present the characteristics of trough response. The centers of concretions are enriched with calcareous or siliceous, and the edges are enriched with clay and organic matter. Third, concretionary layers are mostly distributed in carbonaceous shale and argillaceous shale with TOC contents of 0.8-2.4%, clay content over 40% and brittleness index below 50%, and they are not associated with high-quality shale. Fourth, the Rhuddanian concretionary layer can serve as the marker bed for regional correlation in the middle segment of the Coronograptus cyphus belt in the central part of the Southern Sichuan Depression, while the Aeronian concretionary layer cannot independently serve as the marker bed for regional correlation. Fifth, the concretions are mainly formed in the stage

of syndeposit-early diagenesis and developed in the initial stage-development stage of foreland flexure. They are the products of rapid sedimentation of deep water and semi-deep water continental shelf facies. The spatial distribution characteristics of concretionary layers reflect the migration of the foreland flexural depression from south to north. In conclusion, the combination of concretion layers with graptolites belts and bentonite dense layers is of a great reference value to study the layering of graptolites belts and the distribution of high-quality shale.

Number of references: 27

Main heading: Carbonaceous shale

Controlled terms: Bentonite - Clay minerals - Deposition - Fracture mechanics - Geochemistry

Uncontrolled terms: Concretion - Foreland depression - High quality - Longmaxi Formation - Rapid sedimentation - Sichuan Basin - Silurian

Classification code: 481.2 Geochemistry - 482.2 Minerals - 802.3 Chemical Operations - 931.1 Mechanics

Numerical data indexing: Percentage 4.00e+01%, Percentage 5.00e+01%, Percentage 8.00e-01% to 2.40e+00%

DOI: 10.3787/j.issn.1000-0976.2019.10.002

Database: Compendex

40.

Accession number: 20194807752646

Title: **An oil & gas technological value sharing theory and its construction in China**

Title of translation: **我国油气技术价值分享理论体系及其构建**

Authors: Jiang, Zi'ang ; Gu, Sui ; Ren, Limei

Author affiliation: Technical Advisory Centre, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Natural Gas Economic Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Tight Oil and Gas Exploration and Development Project Division, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610017, China

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Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency

Abstract: To adapt to the development of socialist sharing economy with Chinese characteristics, comply with the basic features that oil and gas production factors create technological value synergistically, and deal with the major challenges in oil and gas technological value evaluation, this paper discussed the framework of a domestic oil & gas technological value sharing theory system from the perspective of management accounting, based on the theories of sharing economy, factor allocation and technological innovation. Then, the design ideas and principles, construction targets and main content of the sharing theory system were determined. And the following research results were obtained. First, the overall target is to establish an oil and gas technological value sharing theory with Chinese characteristics, so as to provide the oil and gas industry and the national relevant departments with the method and theoretical support and the decision making reference for evaluating the oil and gas technological performance accurately and promoting the incentive level. Second, a series of involved theories constitute the theory system of oil and gas technological value sharing, including sharing nature, sharing mode and method, sharing mechanism and sharing management. Finally, based on the status of domestic oil and gas industry, the measures for promoting the construction of the oil and gas technological value sharing theory were proposed as follows. First, speed up the construction of oil and gas technological value evaluation system. Second, establish the management accounting system which supports the oil and gas technological value sharing. Third, strengthen the organization of technological value evaluation and the human resource management. Fourth, build up the intelligent decision-making support system of oil and gas technological value, and strengthen the foreign exchange of technological value evaluation results and the construction of communication platform. In conclusion, the construction of an oil and gas technological value sharing theory system is beneficial for improving and perfecting the driving and the

development mechanism of oil and gas science and technology innovation and can provide a theoretical basis and reference method for the evaluation of technological innovation value of oil and gas enterprises and the formulation of incentive policies.

Number of references: 19

Main heading: Gases

Controlled terms: Decision making - Decision theory - Economics - Gas industry - Human resource management

Uncontrolled terms: Design ideas - Oil and Gas Industry - Sharing mechanism - Sharing theory - Strategy - Technological value

Classification code: 522 Gas Fuels - 912.2 Management - 961 Systems Science - 971 Social Sciences

DOI: 10.3787/j.issn.1000-0976.2019.09.018

Database: Compendex

41.

Accession number: 20200208027886

Title: **Numerical simulation on the migration and deposition of micron-sized sand particles in the helical tube section during hydrate production tests**

Title of translation: **天然气水合物试采中节流螺旋管段微米级砂粒运移沉积规律数值模拟**

Authors: Su, Yinao ; Chen, Ye ; Sun, Xiaofeng ; Yan, Tie ; Qu, Jingyu ; Duan, Ruixi

Author affiliation: College of Petroleum Engineering, Northeast Petroleum University, Daqing; Heilongjiang; 163318, China

CNPC Offshore Engineering Co., Ltd., Beijing; 100028, China

Corresponding author: Chen, Ye (chenyenepu@163.com)

Source title: Natural Gas Industry

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Language: Chinese

ISSN: 10000976

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In the exploitation process of offshore natural gas hydrate ("hydrate" for short), it is necessary to take into consideration the wear of wellbore equipment caused by micron-sized sand particles after their breaking through the sand control facility of the wellbore. At present, however, there is no literature on the migration, deposition and blockage of micron-sized sand particles (<44 μm) after their flowing into the wellbore with the formation fluid. To deal with this situation, this paper took the sand particles in a throttling helical tube section for water transport in the process of depressurization hydrate exploitation as the research object. After a geometric model of flow channel was established for numerical simulation, the migration and deposition laws of micron-sized sand particles were analyzed and the critical non-deposition water velocity of micron-sized sand particles under different conditions was obtained. And the following research results were obtained. First, micron-sized sand particles are mainly accumulated in the helical tube section of a complex pipeline, and the deposition of sand particles is decreases with the increase of water velocity. The sand particles deposited in the upper part of the helical tube section are more difficult to clean than those in the lower part. Second, the critical non-deposition water velocity increases gradually with the increase of sand particle size and sand production concentration. Third, the variables are nondimensionalized by applying the Buckingham-Π theorem. And the model for predicting the sand deposition concentration in the local complex wellbore section during hydrate production test can be obtained using the OriginPro 2019 non-linear fitting tool. Fourth, based on the proposed concept of sand deposition concentration ratio, combined with the deposition prediction model, it is convenient to calculate critical non-deposition water velocity of micron-sized sand particles and to judge the situation of sand deposition in the wellbore. In conclusion, a method for determining the critical non-deposition water velocity of micron-sized sand particles in the local complex wellbore section during the hydrate production test is proposed. And by virtue of this method, the critical non-deposition water velocity of micron-sized sand particles under three particle sizes and three sand production concentrations is obtained respectively. And the research results provide a basis for the reasonable arrangement of hydrate production system and pressure reduction range.

Number of references: 39

Main heading: Sand

Controlled terms: Channel flow - Computer simulation - Deposition - Gas hydrates - Hydration - Natural gas - Numerical models - Offshore boreholes - Offshore gas wells - Offshore oil well production - Oil field equipment - Particle size - Traveling wave tubes - Tubes (components) - Velocity

Uncontrolled terms: Depressurizations - Helical tubes - Ocean - Production system - Sand particles - Water velocities

Classification code: 483.1 Soils and Soil Mechanics - 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 631.1 Fluid Flow, General - 714.1 Electron Tubes - 723.5 Computer Applications - 802.3 Chemical Operations - 921 Mathematics

DOI: 10.3787/j.issn.1000-0976.2019.12.012

Database: Compendex

42.

Accession number: 20193907482137

Title: **Dynamic behaviors of deviation control of the prebent pendulum BHA in gas drilling**

Title of translation: **气体钻井预弯曲钟摆钻具控斜的动力学行为**

Authors: Di, Qinfeng ; Hu, Feifei ; Zhou, Bo ; Wang, Chunsheng ; Li, Ning ; Lou, Erbiao ; Wang, Wenchang

Author affiliation: School of Mechanics and Engineering Science, Shanghai University, Shanghai; 200072, China

Shanghai Institute of Applied Mathematics and Mechanics, Shanghai University, Shanghai; 200072, China

PetroChina Tarim Oilfield Company, Korla; Xinjiang; 841000, China

Corresponding author: Wang, Wenchang (wenchangwang1982@163.com)

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Deviation control is always one of the difficulties that restrict the development of gas drilling technology. In this paper, the dynamic behavior of the bottomhole assembly with the prebent structure (i.e., prebent BHA) was studied. Then, the nonlinear dynamic model of prebent BHA was established based on the Lagrange equation and the dynamic lateral force on the bit was calculated in the simple-beam quasi-static model. Finally, the deviation control capacity of prebent BHA with different structures in gas drilling was designed, evaluated and verified on site. And the following research results were obtained. First, the reasonable prebent pendulum BHA can provide higher dynamic deviation decreasing capacity in gas drilling so as to realize good deviation decreasing effect. When the bend angle of the prebent nipple is 0.75°, the maximum radius of BHA centroid movement is smaller, which indicates that BHA stability is optimum at the bend angle of 0.75°. Second, when there are two drill collars between the bit and the near-bit stabilizer, BHA's motion stability is improved significantly and it is basically located at the center of the borehole, which is quite beneficial for wellbore quality control. Third, during the field application, the prebent pendulum BHA designed in this paper can well control the well deviation in gas drilling. In conclusion, the dynamic control equation of prebent pendulum BHA can describe the motion characteristics of prebent structures, and the prebent pendulum BHA designed in this paper is not only applicable to conventional strata, but also presents a remarkable deviation control effect in the drilling of gravel strata with stronger heterogeneity. The research results promote the development of the low-cost deviation control technologies in gas drilling.

Number of references: 15

Main heading: Quality control

Controlled terms: Boreholes - Drill collars - Drills - Dynamic loads - Dynamics - Equations of motion - Gases - Infill drilling - Nonlinear equations - Pendulums

Uncontrolled terms: Deviation control - Different structure - Dynamic deviations - Gas drilling technologies - Gas drillings - Motion characteristics - Pre bents - Quasi static models

Classification code: 408.1 Structural Design, General - 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 603.2 Machine Tool

Accessories - 913.3 Quality Assurance and Control - 921.2 Calculus

DOI: 10.3787/j.issn.1000-0976.2019.07.012

Database: Compendex

43.

Accession number: 20193607404588

Title: **Shale ultrasonic numerical simulation based on the viscoelastic medium wave theory**

Authors: Chen, Qiao ; Xu, Fenglin ; Cheng, Liang ; Liu, Hong ; Jian, Xu ; Zhu, Honglin ; Chen, Jilong

Author affiliation: Chongqing Institute of Green and Intelligent Technology, Chinese Academy of Sciences, Chongqing; 400714, China

Chongqing Fuling Shale Gas Environmental Protection Research & Development and Technical Service Center, Chongqing; 408000, China

Institute of Geological Exploration and Development of oil CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

Chongqing Fulin Institute of Geology and Mineral Resources, Chongqing; 401123, China

State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Chongqing Technology and Business University, Chongqing; 400067, China

Corresponding author: Zhu, Honglin (zhuhonglin@cigit.ac.cn)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Using the ultrasonic transmission method to study the ultrasonic response characteristics of shale is the basis for the use of logging data to solve geological and engineering problems in shale gas development. However, among few literatures about such related research by present, shale has been only regarded as an elastic medium with its viscoelastic characteristics being unfortunately ignored. In view of this, based on the theory of viscoelastic medium waves, combined with the ultrasonic penetration experiments, we simulated an initial and vibration sources environment as well as boundary and stability conditions. On this basis, we made the ultrasonic transmission experiments of shale with different bedding angles by the staggered grid finite difference method. The following findings were obtained. (1) The waveform trend obtained by numerical simulation is coincided with the physical experiment result. (2) The rules of shale attenuation coefficients varied along with the test frequencies and the bedding angles obtained by numerical simulation calculation and physical experiment based on ideal and real cores agree well with each other. (3) Under a certain constant bedding size and density, the wave velocity declined in power function and the attenuation coefficient increases linearly. In conclusion, this numerical computation method proposed in this paper is scientific and reasonable and is of strong adaptability and can not only be used to analyze the influence of shale bedding characteristics on ultrasonic propagation characteristics from a microscopic point of view, but avoid human errors and save the experimental cost, therefore it is of important theoretical and practical significance.

Number of references: 32

Main heading: Finite difference method

Controlled terms: Computation theory - Computer simulation - Errors - Numerical methods - Numerical models - Shale - Ultrasonic transmission - Viscoelasticity - Wave propagation

Uncontrolled terms: Bedding angle - Human errors - Response characteristic - Visco-elastic mediums - Wave theory

Classification code: 721.1 Computer Theory, Includes Formal Logic, Automata Theory, Switching Theory, Programming Theory - 723.5 Computer Applications - 753.1 Ultrasonic Waves - 921 Mathematics - 921.6 Numerical Methods - 931.2 Physical Properties of Gases, Liquids and Solids

DOI: 10.3787/j.issn.1000-0976.2019.06.007

Database: Compendex

44.

Accession number: 20193207285163

Title: **Mesozoic tectonic evolution and buried hill formation mechanism in the southwestern Bohai Sea**

Authors: Xiao, Shuguang ; Lü, Dingyou ; Hou, Mingcai ; Hu, Hewei ; Huang, Zhi

Author affiliation: Tianjing Branch, CNOOC China Limited, Tianjin; 300459, China

Institute of Sedimentary Geology, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation//Chengdu University of Technology, Chengdu; Sichuan; 610059, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Mesozoic buried hill structures are widely developed in the southwestern Bohai Sea area of the Bohai Bay Basin, but the mechanisms of their genesis and evolution have not been systematically studied. In regard of this, the periods, types and activity characteristics of the faults in this area were analyzed based on the fine stratigraphic interpretation of three-dimensional seismic data and the identification of tectonic styles. Then, the tectonic framework in the key tectonic periods and the formation and evolution process of buried hills were revealed. Finally, the structural characteristics of different zones of buried hills were investigated and the buried hills were classified. And the following research results were obtained. First, there are four stages of tectonic movements inside the buried hills, including Indosinian, early Yanshanian, middle Yanshanian and Himalayan, among which Indosinian and early Yanshanian tectonic movements play a decisive role in controlling the formation and distribution of buried hills.

Second, the four stages of tectonic movements formed four sets of complex grid-like fault systems consisting of three groups of faults (i.e. NE, NW and nearly NS faults), which are obviously different from each other in terms of formation stages, natures and activity characteristics. Third, the evolution of this area is divided into four stages, i.e., the formation of material base of buried hills in Paleozoic, the compressive orogeny and the thrust structure development in Late Triassic-Early Jurassic, the intracontinental rift and the formation of buried hill initial patterns in Late Jurassic-Early Cretaceous, and the strike-slip-extension composite transformation and the burial finalization in Cenozoic. Fourth, due to the differences of the manifestations of key tectonic periods, the structural characteristics of the buried hills in this area are obviously zonal, and they are divided into the residual thrust buried hill belt in the west, the inversion tilt buried hill belt in the central area and the complex strike-slip fault block buried hill belt in the east. It is concluded that the Mesozoic and Cenozoic strata in the southwestern Bohai Sea area undergo multicyclic tectonic movements, which result in the diversity of buried hill types and the complexity of the inner fault systems.

Number of references: 28

Main heading: Strike-slip faults

Controlled terms: Faulting - Seismology - Stratigraphy

Uncontrolled terms: Bohai Bay Basin - Bohai Sea - Buried hill - Formation period - Indosinian - Mesozoic - Tectonic evolution - Yanshanian

Classification code: 481.1 Geology - 484.1 Earthquake Measurements and Analysis

DOI: 10.3787/j.issn.1000-0976.2019.05.004

Database: Compendex

45.

Accession number: 20194207561177

Title: **Effect of pore throat structure on micro-scale seepage characteristics of tight gas reservoirs**

Title of translation: **孔喉结构对致密气微尺度渗流特征的影响**

Authors: Zhang, Liehui ; Liu, Xiangyu ; Zhao, Yulong ; Zhou, Yuan ; Shan, Baochao

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610093, China

State Key Laboratory of Coal Combustion, Huazhong University of Science and Technology, Wuhan; Hubei; 430074, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: At present, the effects of pore throat structure on micro-scale seepage characteristics of tight gas reservoirs are less researched, and traditional numerical simulation methods are faced with a great number of challenges in the study of micro-scale flow. In this paper, the flow pattern of tight gas was studied based on the actual temperature and pressure of tight gas reservoir and the characteristic size of reservoir pore throat, and the rationality of tight gas flow was simulated by means of lattice Boltzmann method. Then, considering the influences of micro-scale effect, slippage effect and other factors, a tight gas flow model was established on the basis of LBGK-D2Q9 model, and its calculation results were compared with the analytical solutions and the numerical solutions listed in the literature. Finally, the influential laws of pore throat structure on the micro-scale seepage characteristics of tight gas were discussed. And the following research results were obtained. First, when the pressure is in the range of 3-70 MPa and the temperature is in the range of 293.15-373.15 K, the Knudsen number (Kn) is less than 0.1 and the gas flow is in the pattern of slippage flow and weak continuous flow. And in this case, it is reasonable to adopt the LBGK-D2Q9 model to simulate tight gas flow. Second, the effect of the characteristic size of the flow channel on the Kn is much greater than that of the pressure change. When the pore-throat ratio is constant, the Kn increases slowly along the throat. And its increasing trend gets more obvious with the increase of pore-throat ratio. Third, the presence of the throat makes the non-linear distribution characteristics of the pressure in the pore

throat significant, and the pressure drop mainly lies in the throat. And the higher the pore-throat ratio is, the larger the pressure drop range in the throat is. Fourth, the non-linear distribution of pressure decreases the gas flow speed significantly, thus reducing the mass flow rate in the flow channel. In conclusion, the simulation result of the model established in this paper is highly coincident with the analytical solutions and the numerical solutions calculated by DSMC and IP methods in the literature, which verifies that this proposed model is reliable. The research results reveal the importance of "connecting fracture and expanding throat" in the practical development engineering of tight gas reservoirs.

Number of references: 25

Main heading: Tight gas

Controlled terms: Analytical models - Channel flow - Drops - Flow of gases - Flow patterns - Gases - Hydrocarbon seepage - Kinetic theory - Numerical methods - Numerical models - Petroleum reservoirs - Pressure drop

Uncontrolled terms: Lattice Boltzmann method - Micro-scale flow - Pore throat structures - Seepage characteristics - Slippage effect - Tight gas reservoirs

Classification code: 512.1.1 Oil Fields - 522 Gas Fuels - 631.1 Fluid Flow, General - 631.1.2 Gas Dynamics - 921 Mathematics - 921.6 Numerical Methods

Numerical data indexing: Pressure 3.00e+06Pa to 7.00e+07Pa, Temperature 2.93e+02K to 3.73e+02K

DOI: 10.3787/j.issn.1000-0976.2019.08.006

Database: Compendex

46.

Accession number: 20193607404735

Title: **A technology of reconstructing salt cavern underground gas storages by use of the old chambers of those existing convection wells**

Authors: Xue, Yu ; Wang, Yuangang ; Zhang, Xinyue

Author affiliation: PetroChina West-East Gas Pipeline Company, Zhenjiang; Jiangsu; 212000, China

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ISSN: 10000976
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Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency
Number of references: 15
Main heading: Underground gas storage
Controlled terms: Caves - Horizontal wells - Infill drilling - Salt deposits - Salt mines - Well drilling
Uncontrolled terms: Chamber volume - Horizontal channels - Pore volume - Reconstructing the old chamber - Salt caverns
Classification code: 481.1 Geology - 505.1 Nonmetallic Mines - 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 522 Gas Fuels
Numerical data indexing: Percentage 2.00e+01% to 4.00e+01%
DOI: 10.3787/j.issn.1000-0976.2019.06.015
Database: Compendex

47.

Accession number: 20195107877743
Title: **Development and application of natural gas closed burners**
Title of translation: **天然气密闭燃烧器的研制与应用**

Authors: Pang, Dongxiao ; Lu, Dengyun ; Han, Xiong ; Wang, Xiuhua ; Wang, Zhimin
Author affiliation: Drilling and Production Engineering Technology Research Institute, CNPC Chuanqing Drilling Engineering Co., Ltd., Guanghan; Sichuan; 618300, China
Chongqing Division of PetroChina Southwest Oil & Gasfield Company, Chongqing; 400011, China

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Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency
Number of references: 17
Main heading: Natural gas wells
Controlled terms: Gas industry - Gases - Ignition - Natural gas - Nozzles - Partial pressure - Pollution control - Pressure control - Thermocouples - Waste incineration
Uncontrolled terms: Light pollution - Natural gas development - Sound pollution - Venturi tube - Waste gas
Classification code: 452.4 Industrial Wastes Treatment and Disposal - 512.2.1 Natural Gas Fields - 521.1 Fuel Combustion - 522 Gas Fuels - 731.3 Specific Variables Control - 944.5 Temperature Measuring Instruments
Numerical data indexing: Decibel 8.50e+01dB, Percentage 9.50e+01%, Size 2.00e+01m
DOI: 10.3787/j.issn.1000-0976.2019.10.016
Database: Compendex

48.

Accession number: 20193907482178

Title: **Numerical simulation of the thermal-hydraulic coupling in wellbore and random fracture network reservoirs**

Title of translation: **随机裂隙网络储层与井筒热流耦合数值模拟**

Authors: Shan, Dandan ; Yan, Tie ; Li, Wei ; Sun, Shihui ; Lu, Guangdong ; Zhao, Huan

Author affiliation: College of Petroleum Engineering, Northeast Petroleum University, Daqing; Heilongjiang; 163318, China

Key Laboratory of Enhanced Oil Recovery, Ministry of Education, Northeast Petroleum University, Daqing;

Heilongjiang; 163318, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 24

Main heading: Thermal insulation

Controlled terms: Boreholes - Computer system recovery - Fracture - Geothermal fields - Heat transfer - Injection (oil wells) - Low temperature production - Oil field equipment - Petroleum reservoir evaluation - Recovery - Seepage - Temperature distribution

Uncontrolled terms: Comsol multiphysics - Enhanced geothermal systems - Mining rates - Output and life - Random fracture - Recovery temperature - Thermal hydraulics - Wellbore

Classification code: 413.2 Heat Insulating Materials - 481.3.1 Geothermal Phenomena - 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512.1.2 Petroleum Deposits : Development Operations - 641.1 Thermodynamics - 641.2 Heat Transfer - 951 Materials Science

Numerical data indexing: Size 4.00e+02m

DOI: 10.3787/j.issn.1000-0976.2019.07.019

Database: Compendex

49.

Accession number: 20192607089031

Title: **Exploration and development potential of the low-maturity continental shale gas in the Fuxin Basin**

Title of translation: 阜新盆地低演化陆相页岩气勘探开发潜力

Authors: Kang, Yongshang ; Rao, Quan ; Zhao, Qun ; Wang, Hongyan

Author affiliation: School of Geosciences, China University of Petroleum, Beijing; 102249, China

State Key Laboratory of Petroleum Resources and Prospecting//China University of Petroleum, Beijing; 102249, China

PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

Corresponding author: Rao, Quan (raoquan1994@qq.com)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to promote the exploration and development of continental shale gas reservoirs in China further, we systematically summarized the geological features of typical continental shale, such as the Ordos Basin. Then, the shale gas reservoir characteristics, geochemical characteristics and fracturing performance of the Lower Cretaceous Shahai Fm in the Fuxin Basin were analyzed by using the data of TOC contents, rock specific surface, pore size distribution and X-ray diffraction analysis of the whole rock. Based on this, it was compared with the marine/continental shale gas reservoirs from the aspect of geological feature. Finally, the shale gas reservoir and resource potential of the Shahai Fm were evaluated. And the following research results were obtained. First, the formation age of China's continental shale is later, its TOC contents vary in a large range, and its organic matters are mainly of a mixed-humic type. And it is characterized by low thermal evolution degree, low quartz content, high feldspar content, high carbonate content, and comparability of total brittle mineral content to marine shale. Second, shale in the Shahai Fm has

shallow burial depth and its mineral composition is dominated by quartz, feldspar and carbonate minerals. Its pores are mainly mesopores with an average porosity of 3.47%. There are diverse reservoir spaces, which is favorable for the accumulation of shale gas. Third, the TOC content of the Shahai Fm shale is mainly above 2%, with a moderate thermal evolution degree of organic matter and high gas content. Fourth, the total brittle mineral content of Shahai Fm shale is up to 60%, indicating a good fracturing performance. Fifth, shale reservoirs in the Shahai Fm can be classified into three categories. Type one is target reservoirs of exploration and development, and Type two is favorable reservoirs. It is estimated that the amount of shale gas resources are in the range of 232.2-286.2 billion m. It is concluded that the Shahai Fm shale in the Fuxin Basin has both resource potential in geology and fracturing performance in engineering, and its exploration and development prospect is broad. What's more, the potential of commercial shale gas development is great in the sweet-point areas.

Number of references: 39

Main heading: Petroleum prospecting

Controlled terms: Biogeochemistry - Energy resources - Feldspar - Fracture - Gases - Geology - Organic compounds - Petroleum reservoir evaluation - Petroleum reservoirs - Pore size - Quartz - Shale gas - X ray powder diffraction

Uncontrolled terms: Early Cretaceous - Fuxin Basin - Geochemical characteristic - Geological features - Resource potentials

Classification code: 481.1 Geology - 481.2 Geochemistry - 482.2 Minerals - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 525.1 Energy Resources and Renewable Energy Issues - 804.1 Organic Compounds - 951 Materials Science

Numerical data indexing: Percentage 2.00e+00%, Percentage 3.47e+00%, Percentage 6.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.03.003

Database: Compendex

50.

Accession number: 20192607089043

Title: **Risk assessment on mountain torrents and debris flows along long-distance pipelines based on the GIS and coupling-coordination principle**

Title of **基于GIS及耦合协调原理的长输管道山洪泥石流风险性评价**

translation:

Authors: Xiong, Junnan ; Sun, Mingyuan ; Sun, Ming

Author affiliation: School of Civil Engineering and Architecture, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

The First Surveying and Mapping Institute of Sichuan Province, Chengdu; Sichuan; 610100, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 3

Issue date: March 25, 2019

Publication year: 2019

Pages: 116-124

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Debris flows and mountain torrents are the main geologic disasters affecting the safe operation of long-distance oil and gas pipelines in mountainous areas. It is of great significance to carry out risk assessment on the disasters of debris flows and mountain torrents along long-distance oil and gas pipelines to prevent and alleviate the losses. In this paper, the Guangyuan section of the Lanzhou-Chengdu-Chongqing long-distance oil and gas pipeline was taken as the research object. Based on the coupling-coordination principle, an overall risk evaluation system was divided into two subsystems, i.e., a pipe subsystem and a natural environment subsystem. The pipe subsystem includes 5 indicators: depth, included angle (included angle between pipe and slope unit), wall thickness, defect density and position (distance between pipe and slope unit). The natural environment subsystem includes 9 indicators: slope direction, slope, elevation, normalized differential vegetation index (NDVI), annual average precipitation, height difference, topographic section curvature, distance between pipe and fault, and geological lithology. Then, the weight of each indicator was determined by means of entropy weight method. Finally, the coupling-coordination model for the system was established by using the GIS technology, and the risk level of the long-distance pipeline in this area was defined. And the following research results were obtained. First, the coupling coordination degree is better accordant with the risk degree. Second, the risk degree

and coupling coordination degree of the pipeline in the southern part of the study area are higher, which indicates that the natural environment, geological structure and climate change in this area tend to induce natural disasters easily, e.g. mountain torrents and debris flows. Third, the weight of the defect density of pipe subsystem and that of the NDVI index of natural environment subsystem are the highest, so it is recommended to strengthen monitoring pipe damage and vegetation change in the Guangyuan pipeline section. In conclusion, this evaluation method can reflect the actual field situations rapidly and accurately and it is better applicable in pipeline risk evaluation.

Number of references: 34

Main heading: Pipelines

Controlled terms: Climate change - Debris - Defect density - Disaster prevention - Disasters - Entropy - Geographic information systems - Landforms - Lithology - Risk assessment - Vegetation - Water pipelines

Uncontrolled terms: Chengdu - Coordination model - Debris flows - Entropy weight method - Long distance pipelines - Mountain torrent - Risk levels

Classification code: 443.1 Atmospheric Properties - 481.1 Geology - 619.1 Pipe, Piping and Pipelines - 641.1 Thermodynamics - 903.3 Information Retrieval and Use - 914.1 Accidents and Accident Prevention - 933.1 Crystalline Solids

DOI: 10.3787/j.issn.1000-0976.2019.03.015

Database: Compendex

51.

Accession number: 20192607089039

Title: **A 3D-VCCT based method for the fracture analysis of gas line pipes with multiple cracks**

Title of translation: **基于3D-VCCT的多裂纹输气管道断裂分析方法**

Authors: Yao, Anlin ; He, Wenbo ; Xu, Taolong ; Jiang, Hongye ; Gu, Dongfang

Author affiliation: Petroleum Engineering School, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Oil & Gas Fire Protection Key Laboratory of Sichuan Province, Chengdu; Sichuan; 610500, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: March 25, 2019

Publication year: 2019

Pages: 85-93

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The current national criteria with more conservative evaluation results can not accurately reflect the interference effect of multiple cracks on the safety assessment of gas line pipes. In view of this, we compared the singular element method with the three-dimensional virtual crack closure technology (3D-VCCT). Based on this, the 3D-VCCT was selected to establish a multi-crack interference model of gas line pipes. Finally, the interference effect of subsidiary cracks on the front points of the main crack was studied by analyzing the variation of the interference factors between cracks. And the following research results were obtained. First, as the subsidiary crack size changes, the strongest interference effect of a parallel collinear crack occurs near the surface and manifests as enhancement effect. Second, under certain conditions, the interference effect of a parallel collinear crack is more significant at the deepest point and the surface point of the crack, and it presents as an enhancement effect at the deepest point and as a weakening effect at the surface point. Third, when the horizontal spacing between cracks is greater than 6 times of the long half axis of the main crack, the interference effect between the parallel collinear crack and the parallel offset crack is negligible, and multiple cracks can be simplified as a single crack in the process of analysis. This research can provide a technical reference for fracture analysis on multi-crack gas line pipes and the theoretical basis for their safety assessment.

Number of references: 18

Main heading: Pipelines

Controlled terms: Crack closure - Fracture - Gas pipelines - Gases - Safety engineering - Stress intensity factors

Uncontrolled 3D-VCCT - Interference effects - Main crack - Multiple crack

terms: - Singular elements

Classification code: 619.1 Pipe, Piping and Pipelines - 914 Safety Engineering - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.03.011

Database: Compendex

52.

Accession number: 20192607106200

Title: **A major discovery in Permian volcanic rock gas reservoir exploration in the Sichuan Basin and its implications**

Title of translation: **四川盆地二叠系火山碎屑岩气藏勘探重大发现及其启示**

Authors: Ma, Xinhua ; Yang, Yu ; Zhang, Jian ; Xie, Jirong

Author affiliation: PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Exploration Division of PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 2

Issue date: February 25, 2019

Publication year: 2019

Pages: 1-8

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Recently, a high-yield gas flow of 22.5×10 m/d was achieved in the wildcat well Yongtan 1, deployed by the PetroChina Southwest Oil and Gasfield Company, and an extrusive facies vocaniclastic gas reservoir was first discovered in the Sichuan Basin, which is a major breakthrough in the exploration of volcanic rock gas reservoirs. In order to further evaluate the

exploration potential in Permian volcanic rock gas reservoirs in this basin, we systematically reviewed and summarized the exploration process of volcanic rocks in this study area, as well as the characteristics of gas reservoirs of well Yongtan 1, the controlling factors and modes of hydrocarbon accumulation. The following findings were obtained. (1) Over the past five decades of gas exploration of volcanic rocks, the change of exploration thought and progress in seismic prediction contribute to a major discovery in this study area, i.e., the well location deployment of Yongtan 1 was determined in the Jianyan area, where the volcanic anomalies of the Permian developed outbursts are well developed and the gas reservoir conditions are favorable. This also proves that another new gas exploration area in this basin was found. (2) From the data of Yongtan 1, we found high-quality volcanic porous reservoirs with a thickness of over 100 m developed in the Permian strata, the effusive volcanic rock types dominated by breccia and tuffaceous breccia, reservoir space composed of dissolution pores, interbreccia dissolution pores, and other pores, the porosity of which is between 6.68% and 13.22% and 10.26% on average, the permeability between 0.01 and 4.43 mD and 2.35 mD on average. (3) This abnormally high pressure gas reservoir was buried 4 500-6 000 m deep underground with the middle formation pressure being 125.625 MPa and the pressure coefficient being up to 2.22. Methane content in the minor H2S-bearing produced gas flow reached up to 99.03%. (4) Volcanic rocks in the Jianyang- Zhongjiang-Santai area are developed, and they are adjacent to the Cambrian high-quality source rocks in the Deyang-Anyue rifting. The early extensional deep faults play a role in connecting source and storage. There are many sets of caprocks, such as the Upper Permian Longtan Formation and Lower Triassic layered thick paste rocks, providing conditions for forming large-scale tectonic-lithologic composite trap gas reservoirs, and the favorable exploration area reaches up to 6 000 km. In conclusion, this major discovery not only proves that Permian volcanic rocks in the Sichuan Basin has large potential for oil and gas exploration, but reaffirms the confidence in changing our exploration thought, speeding up new exploration zones and areas, and discovering mo re and bigger gas fields.

Number of references: 23

Main heading: Discovery wells

Controlled terms: Digital storage - Dissolution - Flow of gases - Gas industry - Gases - Geological surveys - Natural gas wells - Natural gasoline plants - Petroleum prospecting - Petroleum reservoir engineering - Petroleum reservoirs - Volcanic rocks - Volcanoes - Wildcat wells

Uncontrolled Effusive facies - Gas reservoir - Major breakthrough - Natural

terms: gas exploration - Permian - Sichuan Basin

Classification code: 481.1 Geology - 482.2 Minerals - 484 Seismology - 512 Petroleum and Related Deposits - 513.2 Petroleum Refineries - 522 Gas Fuels - 631.1.2 Gas Dynamics - 722.1 Data Storage, Equipment and Techniques - 802.3 Chemical Operations

Numerical data indexing: Area 6.00e+09m2, Percentage 1.03e+01%, Percentage 6.68e+00% to 1.32e+01%, Percentage 9.90e+01%, Pressure 1.26e+08Pa, Size 1.00e+02m, Size 4.50e+03m to 6.00e+03m

DOI: 10.3787/j.issn.1000-0976.2019.02.001

Database: Compendex

53.

Accession number: 20193207284736

Title: **A new type of automatic ball injector for multistage fracturing**

Authors: Wang, Hanxiang ; Che, Jiaqi ; Liu, Yanxin ; Lan, Wenjian ; Zhang, Yanwen ; Lü, Xiaoxiao ; Du, Mingchao

Author affiliation: College of Electromechanical Engineering, China University of Petroleum <East China>, Qingdao; Shandong; 266580, China

Corresponding author: Che, Jiaqi (cjqupc@163.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: April 25, 2019

Publication year: 2019

Pages: 76-81

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Ball fracturing is a kind of technology that is commonly used for multistage fracturing of shale gas horizontal wells. At present, the ball injector cannot satisfy the operation demands of large bore and small spacing fracturing of shale gas wells due to its disadvantages, such as a small size of fracturing ball, a limited number of balls, complicated structure and poor applicability. In

this paper, a new type of automatic ball injector with rotating plate and large bore was designed. There is a ball storage at the upper part of the ball injector and a ball injecting mechanism inside the pedestal at the lower part. And the ball injecting mechanism is controlled by the drive motor to inject the balls one by one. Then, collision analysis was carried out on its ball injecting process by using finite element method (FEM). Finally, simulation and prototype tests were conducted by using the arbitrary Lagrangian-Eulerian (ALE) mesh adaption method and the coupled smoothed particle hydrodynamics method (FEM-SPH). And the following research results were obtained. First, in the process of ball collision, the maximum equivalent stress, equivalent plastic strain and displacement are generated at the edge of the rotating plate. The maximum stress is about 600 MPa, which is less than the yield strength of 42CrMo (930 MPa), so the strength requirement is satisfied with a certain safety margin. Second, the prototype successfully passes the continuous ball injecting test of 12-stage fracturing process with the ball diameter of 64-108 mm and the ball contrast of 4 mm. In conclusion, this automatic ball injector with rotating plate and large bore is advantageous with simple operation and wide applicability and can effectively address the needs of multistage fracturing of shale gas horizontal wells.

Number of references: 20

Main heading: Well spacing

Controlled terms: Binary alloys - Chromium alloys - Finite element method - Fracture - Horizontal wells - Hydrodynamics - Molybdenum alloys - Particle size analysis - Plates (structural components) - Shale gas

Uncontrolled terms: Arbitrary Lagrangian Eulerian - Ball injector - Complicated structures - Equivalent plastic strain - Large bore - Multistage fracturing - Plate-Type - Smoothed particle hydrodynamics methods

Classification code: 408.2 Structural Members and Shapes - 512.1.1 Oil Fields - 522 Gas Fuels - 543.1 Chromium and Alloys - 543.3 Molybdenum and Alloys - 921.6 Numerical Methods - 951 Materials Science

Numerical data indexing: Pressure 6.00e+08Pa, Pressure 9.30e+08Pa, Size 4.00e-03m, Size 6.40e-02m to 1.08e-01m

DOI: 10.3787/j.issn.1000-0976.2019.04.010

Database: Compendex

54.

Accession 20195107877698

number:

Title: **Setting optimization schemes of a gas pipeline compressor plant**

Title of translation: **输气管道压缩机厂房设置优选方案**

Authors: Dong, Pingsheng ; Liu, Shaoshan ; An, Yunpeng ; Wu, Fengrong ; Huang, Lei

Author affiliation: China Petroleum Pipeline Engineering Corporation, Langfang; Hebei; 065000, China

Changchun Oil & Gas Transportation Sub-Company, PetroChina Pipeline Co., Ltd., Changchun; Jilin; 130000, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 10

Issue date: October 25, 2019

Publication year: 2019

Pages: 103-109

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Gas pipeline compressor plants are set mainly in two forms, i.e., independent plants and joint plants. The former is safe and flexible, but covers a large area and needs high investment, while the latter covers a small area and requires low investment, but its safety and flexibility is poor. Facing the ever-increasing safety and environmental protection requirements and increasingly shortage of land, the setting form of a newly built gas pipeline compressor plant has attracted much attention and controversy. In this paper, the setting requirements of compressor plants stipulated in the standards and specifications of North America, the former Soviet Union, Europe, and China were studied systematically, and the actual setting approaches adopted in several domestic and foreign famous pipeline projects were investigated. Then, based on the actual engineering, quantitative risk analysis and economic evaluation were carried out on the two schemes of independent plants and joint plants by means of a specialized software. And the following research results were obtained. First, there is no clear requirements on the setting form of compressor plants in domestic and foreign main design specifications. Second, in

Canada and the former Soviet Union, independent plants are widely applied. In the United States and Europe, both independent and joint plants are commonly applied. And in domestic market, joint plants are usually applied. Third, from the safety perspective of stations and gas pipeline systems, independent plants are superior to joint plants. From the economic perspective, joint plants are much better. Fourth, if both schemes are compared from the aspect of land acquisition, taking 4 compressor sets as an example, an independent plant scheme requires about 3 600 m more land, in this way a joint plant scheme seems more dominate. However, if in the construction of gas compressor stations of long-distance pipeline with much more land easier to occupy, an independent plant scheme should be recommended.

Number of references: 26

Main heading: Gas compressors

Controlled terms: Compressibility of gases - Computer system recovery - Economic analysis - Fires - Gas plants - Gases - Pipelines - Risk analysis - Risk assessment - Safety engineering - Specifications - Water pipelines

Uncontrolled terms: Compressor plants - Compressor stations - Economic evaluations - ESD system - Independent plant - Long distance pipelines - Quantitative risk analysis - Specialized software

Classification code: 522 Gas Fuels - 618.1 Compressors - 619.1 Pipe, Piping and Pipelines - 902.2 Codes and Standards - 911.2 Industrial Economics - 914 Safety Engineering - 922 Statistical Methods - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Area 3.60e+03m2

DOI: 10.3787/j.issn.1000-0976.2019.10.013

Database: Compendex

55.

Accession number: 20194807752780

Title: **A frequency-divided gas prediction technology based on resistivity constraint**

Title of translation: **基于电阻率约束的分频含气性预测技术**

Authors: Luo, Jing ; Wu, Furong ; Zhang, Dongjun ; Xu, Min ; Chen, Hui ; Fan, Jun ; Zhang, Liming ; Zhao, Zhenwei

Author affiliation: Southwest Geophysical Prospecting Research Institute, BGP Inc., China National Petroleum Corporation, Chengdu; Sichuan; 610213, China

Shale Gas Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610056, China

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Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: September 25, 2019

Publication year: 2019

Pages: 33-38

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The gas-water relationship in the Permian and Triassic biohermal beach reservoirs in the Sichuan Basin is complex, which results in a low drilling success rate and leads to sidetracking or even secondary sidetracking in some wells. Therefore, high-precision gas-water identification is the key to the drilling success rate. In this paper, the biohermal gas reservoir in the T work area of the eastern Sichuan Basin was taken as an example. Firstly, the frequency information of seismic data sensitive to gas bearing properties was exploited sufficiently by taking the deep/shallow resistivity information which is sensitive to gas-water discrimination as a constraint and the nonlinear algorithm as a bridge. Then, combined with the information of full-band relative wave impedance, a nonlinear mapping relationship between the logarithmic difference curve of deep/shallow resistivity and the seismic waveform was established, and the gas bearing properties of the reservoir were predicted. In this way, a post-stack gas prediction method was developed. Finally, field application and effect analysis were carried out. And the following research results were obtained. First, gas layer information indicated by deep/shallow resistivity not only has the function of verification well, but can be extracted as a priori information for the constraint of seismic data. Second, frequency division information increases the mapping relationship between multi-frequency data volume and the logarithmic difference of deep/shallow resistivity, and the colored inversion, as the more reasonable full-band relative-wave impedance seismic data, is more conducive to gas and water identification. Third, based on

the nonlinear mapping relationship, the data volume of a gas sensitive factor was obtained, and the range of gas layers was quantified, so as to realize the quantitative characterization of gas bearing properties. It is concluded that the gas prediction technology developed in this paper provides an effective and practical post-stack gas prediction method, and its field application effect is good, presenting wide popularization and application prospects.

Number of references: 22

Main heading: Petroleum prospecting

Controlled terms: Beaches - Flue gases - Forecasting - Frequency dividing circuits - Gas bearings - Gases - Geophysical prospecting - Infill drilling - Mapping - Oil bearing formations - Petroleum reservoirs - Seismic response - Seismic waves

Uncontrolled terms: Frequency division - Nonlinear algorithms - Sichuan Basin - Triassic - Wave impedances

Classification code: 405.3 Surveying - 407.3 Coastal Engineering - 451.1 Air Pollution Sources - 481.4 Geophysical Prospecting - 484 Seismology - 484.2 Secondary Earthquake Effects - 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 601.2 Machine Components - 713.5 Electronic Circuits Other Than Amplifiers, Oscillators, Modulators, Limiters, Discriminators or Mixers

DOI: 10.3787/j.issn.1000-0976.2019.09.004

Database: Compendex

56.

Accession number: 20200208027832

Title: **A prediction model for the critical liquid-carrying velocity of gas-liquid stratified flow in micro-tilting line pipes with low liquid contents**

Title of translation: **微倾管中低含液率气液分层流临界携液流速预测模型**

Authors: Pan, Jie ; Pu, Xuelei ; Wang, Wujie ; Yan, Minmin ; Wang, Liangliang

Author affiliation: College of Petroleum Engineering, Xi'an Shiyou University, Xi'an; Shaanxi; 710065, China

Institute of New Energy Science and Engineering, University of Shanghai for Science and Technology, Shanghai; 200093, China

No.4 Gas Production Plant, PetroChina Changqing Oilfield Company, Ordos; Inner Mongolia; 017300, China

Source title: Natural Gas Industry

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Pages: 124-133

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Wet gas can form liquid loading at the lower line pipe sections, so the transportation efficiency will be impacted and the line pipes will be corroded and even blocked. Therefore, to accurately predict the critical liquid-carrying velocity of gas is of great significance to preventing the liquid loading in wet gas line pipes. In view of the gas-liquid two-phase stratified flow in micro-tilting line pipes with low liquid contents, this paper newly established a critical liquid-carrying velocity prediction model considering droplet entrainment according to the momentum balance equation of a gas-liquid two-phase flow and the closure relationship of a new gas-liquid interface shape. Then, based on the experimental data, the new model, FLAT model, ARS model, double-circle model and MARS model were verified and their prediction results were compared. Finally, the new model was applied to analyze the effects of pipe dip, operation pressure, liquid density and gas component on the critical liquid-carrying velocity and critical liquid content of natural gas-water and natural gas-60% glycerine with water stratified flow in a micro-tilting line pipe. And the following research results were obtained. First, with the increase of pipe dip and liquid density, the critical liquid-carrying velocity increases continuously and the critical liquid content decreases gradually. Second, with the increase of operation pressure and heavy component content, the critical liquid-carrying velocity decreases continuously and the critical liquid content increases gradually. In conclusion, the new model is higher in prediction accuracy and its prediction result is better accordant with the experimental value, so it can be used to predict the critical liquid-carrying velocity in wet gas line pipes.

Number of references: 26

Main heading: Phase interfaces

Controlled terms: Aerodynamics - Density of gases - Density of liquids - Drops - Forecasting - Gases - Hydrodynamics - Liquefied natural gas - Pipeline corrosion - Shear flow - Shear stress - Thermal stratification - Two phase flow - Velocity

Uncontrolled terms: Droplet entrainment - Friction factors - Interface shape - Line pipes - Liquid fraction - Stratified flows

Classification code: 523 Liquid Fuels - 631.1 Fluid Flow, General - 651.1 Aerodynamics, General - 801.4 Physical Chemistry - 931.2 Physical Properties of Gases, Liquids and Solids

DOI: 10.3787/j.issn.1000-0976.2019.12.016

Database: Compendex

57.

Accession number: 20193207284605

Title: **Reflections and suggestions on the development and engineering management of shale gas fracturing technology in China**

Authors: Liu, He ; Meng, Siwei ; Su, Jian ; Zhang, Guangming ; Chen, Lin

Author affiliation: PetroChina Research Institute of Petroleum Exploration & Development, Beijing; 100083, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 1-7

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Shale gas resource in China is greatly different from that in the North America in term of natural endowment, so North America's experience and practice of shale gas revolution shall not be copied blindly in China. In order to realize scale effective development of shale gas resource in China, we analyzed and summarized the status quo of domestic shale gas stimulation

technologies referring to the advanced concepts of shale gas development in the North America, considering the actual situations of shale gas resource in China. Then, some suggestions were proposed on the development direction of key shale gas fracturing technologies and the enhancement of engineering management. First, a data volume that integrates geological, engineering and production information is the base for designing and optimizing all segments of shale gas exploration, development and production. Therefore, it is necessary to break the "data isolated island", strengthen data mining and improve the data application efficiency, so as to promote the integration of geo-engineering data fusion. Second, the geomechanics test & evaluation method and technology suitable for shale reservoirs shall be developed and improved by taking into consideration the anisotropic mechanical behaviors and ground stress characteristics of shale reservoirs, so as to increase the design level of geo-engineering integration program. Third, it is necessary to develop the dissolvable bridge plug, improve operation the efficiency of staged fracturing and reduce the operation risk, so as to achieve cost reduction and benefit increase of shale gas development. Fourth, there is still great room for the improvement of the engineering management system, which is worth exploring and studying further. Therefore, oil & gas industry and companies shall seize this critical strategic opportunity to actively optimize the current engineering management pattern and seek the optimal approach to quality improving and benefit increasing. In conclusion, the exploration and development of shale gas in China is currently in the early stage and there is an obvious gap compared with foreign countries in terms of technology & equipment, production management, exploration and development achievement and policy & regulation. Therefore, it is in an urgent need to innovatively explore a way feasible for the actual shale gas development in China based on the resource conditions of its own after referring, digesting and absorbing the hydraulic fracturing experience and management concept of shale gas revolution in the United States.

Number of references: 29

Main heading: Information management

Controlled terms: Big data - Cost reduction - Data fusion - Data integration - Data mining - Efficiency - Energy resources - Fracture - Gas industry - Gases - Geological surveys - Geomechanics - Hydraulic fracturing - Hydraulic machinery - Integration - Petroleum deposits - Petroleum prospecting - Petroleum reservoir evaluation - Shale gas - Software testing

Uncontrolled terms: China - Development directions - Dissolvable bridge plug - Engineering management - Exploration and development -

Exploration and development achievements - North America - Production management

Classification code: 481 Geology and Geophysics - 481.1 Geology - 512.1 Petroleum Deposits - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 525.1 Energy Resources and Renewable Energy Issues - 632.2 Hydraulic Equipment and Machinery - 723.2 Data Processing and Image Processing - 723.5 Computer Applications - 913.1 Production Engineering - 921.2 Calculus - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.04.001

Database: Compendex

58.

Accession number: 20193907482176

Title: **Geophysical characteristics and distribution prediction of the Permian karst reservoirs in the Hebaochang area, South Sichuan Basin**

Title of translation: **四川盆地荷包场地区二叠系岩溶储层地球物理特征与分布预测**

Authors: Chen, Xiaoyue ; Li, Jianzhong ; Jiang, Qingchun ; Huang, Shipeng ; Lu, Weihua ; Su, Wang ; Wu, Ya

Author affiliation: PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

Shunan Division, PetroChina Southwest Oil & Gasfield Company, Luzhou; Sichuan; 646001, China

Corresponding author: Jiang, Qingchun (jiangqc@petrochina.com.cn)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Previous studies on the karst reservoirs of Maokou Fm, Middle Permian in the Southern Sichuan Basin mainly concentrate on sedimentary facies, reservoir characteristics and controlling factors, gas accumulation patterns and gas-source correlation, and well location deployment is carried out with faults as the focus. Due to the limitation of seismic data quality and other factors, this set of reservoirs are less analyzed qualitatively and predicted quantitatively. In this paper, the seismic response characteristics of high yield gas wells in karst reservoirs were analyzed based on the above mentioned traditional research achievements, combined with the 3D seismic data in the Hebaochang area of the Southern Sichuan Basin. Then, qualitative analysis, quantitative prediction and hydrocarbon detection were carried out on the karst reservoirs of Maokou Fm, Middle Permian by means of forward modeling, amplitude attribute analysis, hydrocarbon detection and other methods. Finally, the favorable areas for the development of karst reservoirs were predicted. And the following research results were obtained. First, the Maokou karst reservoirs in the Hebaochang area are vertically stratified and high yield intervals are mainly developed at the upper sections within 50 m from the top of Maokou Fm. The events of high yield intervals, i.e., top Maokou Fm and the lower part, present the seismic response characteristics of "weak peak & weak and wide valley". The quantitative prediction of amplitude index attribute and the hydrocarbon detection results show that both of them are coincident and there are 3 high-quality reservoir development zones in this area. And their coincidence with the actual wells is up to 80%. It is concluded that besides the favorable reservoir areas developed along the faults in the Hebaochang area, 3 favorable karst reservoir areas are developed far from the fault belt, the total area of which is 79 km. The research results are of great significance to guiding the oil & gas exploration and well location deployment in the structural slope and syncline areas far from faults.

Number of references: 32

Main heading: Petroleum prospecting

Controlled terms: Forecasting - Geophysical prospecting - Hydrocarbons - Landforms - Seismic response - Seismic waves

Uncontrolled terms: Favorable exploration area - Forward simulation - Karst reservoirs - Permian - Seismic attributes - Seismic response characteristics - Sichuan Basin - Southern area

Classification code: 481.1 Geology - 481.4 Geophysical Prospecting - 484 Seismology - 484.2 Secondary Earthquake Effects - 512.1.2 Petroleum Deposits : Development Operations - 804.1 Organic Compounds

Numerical data indexing: Area 7.90e+07m2, Percentage 8.00e+01%, Size 5.00e+01m

DOI: 10.3787/j.issn.1000-0976.2019.07.005

Database: Compendex

59.

Accession number: 20200408064870

Title: **New technology of gas recovery by the combined drainage of pumping-velocity strings**

Title of translation: **机抽-速度管复合排水采气新工艺**

Authors: Su, Chao ; Wei, Lei ; Wu, Suwei

Author affiliation: Geological Exploration and Development Research Institute, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

University of Calgary, Calgary; AB; T2N1N4, Canada

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 11

Issue date: November 25, 2019

Publication year: 2019

Pages: 81-85

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to improve the applicability of commonly used drainage gas recovery technologies while reducing the additional cost caused by the adjustment of drainage technologies, this paper improved the pumping process using the hollow sucker rod. And combined with the newly developed special air-proof hollow pump for drainage gas recovery, a gas recovery process by combined drainage of pumping-velocity string was formed. Then, field test was carried out at a water-production gas well in the Sulige Gas Field. And the following research results were obtained. First, in this new process, pumping, velocity string, gas lift, foam scrubbing and other drainage technologies can be

combined freely, and drainage technologies can be flexibly adjusted according to the water production characteristics of the gas well. And thus the adaptability of the process is improved. Second, the traveling valve and the static valve adopted in this process all depend on the driving force of the pumping unit and the gravity of the hollow sucker rod to realize the forced opening and closing, so the mechanical pumping failure caused by the gas lock and sand sticking is avoided. Third, the selection principles of the gas well in this process include higher initial gas production rates (>1×10 m/d), higher water production rates (3-30 m/d) and short distances from the wellhead to the liquid surface (<2 500 m). Fourth, as for the gas wells with a gas production rate of 2×10 m/d or 1×10 m/d, it is necessary to adopt the hollow sucker rod 36 mm in outer diameter and 6 mm in wall thickness or 38 mm in outer diameter and 6 mm in wall thickness for the drainage gas recovery of velocity string. And for the gas wells with a gas production rate of 0.6×10 m/d, it is necessary to adopt the hollow sucker rod 34 mm in outer diameter and 5.5 mm in wall thickness. In conclusion, the gas recovery process by combined drainage of pumping-velocity string can increase the stable gas production rate of water-production gas wells greatly and realize the continuous stable production of water-production gas wells, presenting good application effects.

Number of references: 16

Main heading: Wellheads

Controlled terms: Air - Catchments - Gas industry - Gases - Locks (fasteners) - Natural gas well production - Natural gas wells - Oil well pumps - Optical pumping - Pumps - Recovery - Valves (mechanical) - Velocity

Uncontrolled terms: Drainage gas recovery - Hollow sucker rods - Ordos Basin - Sulige gas field - Velocity string

Classification code: 512.2.1 Natural Gas Fields - 522 Gas Fuels - 601.2 Machine Components - 618.2 Pumps - 804 Chemical Products Generally

Numerical data indexing: Size 3.40e-02m, Size 3.60e-02m, Size 3.80e-02m, Size 5.50e-03m, Size 6.00e-03m

DOI: 10.3787/j.issn.1000-0976.2019.11.010

Database: Compendex

60.

Accession number: 20200408064753

Title: **Seismic detection of the pore and fracture zones in ultradeep**

carbonate reservoirs in the northwestern Sichuan Basin

Title of translation: 四川盆地西北部超深层碳酸盐岩孔缝带地震检测

Authors: Xu, Minghua ; Fu, Jianyuan ; Yang, Xun ; Liu, Junhai ; Wang, Yufeng

Author affiliation: Geological Exploration and Development Research Institute, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

Northwest Sichuan Division, PetroChina Southwest Oil & Gasfield Company, Jiangyou; Sichuan; 621741, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 11

Issue date: November 25, 2019

Publication year: 2019

Pages: 18-24

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In recent years, great breakthroughs have been realized in the exploration of ultradeep marine carbonate gas reservoirs in the northwestern Sichuan Basin, high-yield gas flow has been produced from the third Member of Maokou Formation, Middle Permian (Mao 3 Member for short) in many structures, and fracture has been proved to be the main factor controlling the high yield of natural gas. However, conventional seismic processing technologies are poor in fracture identification and prediction effect. This paper took the Jiulongshan structure in the northwestern Sichuan Basin as the example. After the characteristics of Mao 3 Member reservoir were summarized, the seismic response characteristics of Mao 3 Member reservoir in drilled wells were analyzed. Then, the optimization processing of original pre-stack gather and the high-resolution treatment of spectrum restoration were carried out to increase the resolution of seismic data while the weak seismic signals of developed fractures and vugs were maintained. Based on this, fracture detection was conducted using post-stack seismic attribute processing technologies, e.g. I3D symmetry, frequency division chaotic body and likelihood. Finally, the areal distribution characteristics of fractures and vugs in Mao 3 Member were

predicted by virtue of three-color fusion technique. And following research results were obtained. First, the ultradeep carbonate reservoirs of Mao 3 Member in the northwestern Sichuan Basin are mostly karst fractured reservoirs with developed structural fractures and dissolved pores and fractures, which tend to form larger fracture development zones easily. Second, the original seismic data of the ultradeep reservoirs in this area has a primary frequency of 25-30 Hz, which cannot respond to fracture belts strongly. The combination of pre-stack gather optimization processing technique and spectrum restoration technique can protect the weak signals of fracture belts and increase the primary frequency of seismic data to 45 Hz, so that the spectrum of seismic data is improved effectively and the geological phenomena are embodied clearly. Third, I3D symmetry, frequency division chaotic body and likelihood can reflect the geological information expressed by the seismic data from different viewpoints, and three-color fusion technique can better reflect fault development belts and karst pores and fracture development belts of Mao 3 Member carbonate reservoirs. In conclusion, the seismic based fracture prediction result is in accordant with drilling, logging and testing results, so as to provide the basis for the deployment and adjustment of natural gas development wells.

Number of references: 16

Main heading: Fracture

Controlled terms: Carbonation - Flow of gases - Fracture testing - Geology - Geophysical prospecting - Infill drilling - Landforms - Natural gas - Natural gas well logging - Natural gas wells - Petroleum prospecting - Petroleum reservoirs - Restoration - Seismic response - Seismic waves - Well testing

Uncontrolled terms: Fracture detection - Fractured reservoir - Frequency division - Likelihood - Permian - Sichuan Basin - Ultra deeps

Classification code: 481.1 Geology - 481.4 Geophysical Prospecting - 484 Seismology - 484.2 Secondary Earthquake Effects - 511.1 Oil Field Production Operations - 512 Petroleum and Related Deposits - 522 Gas Fuels - 631.1.2 Gas Dynamics - 802.2 Chemical Reactions - 951 Materials Science

Numerical data indexing: Frequency 2.50e+01Hz to 3.00e+01Hz, Frequency 4.50e+01Hz

DOI: 10.3787/j.issn.1000-0976.2019.11.003

Database: Compendex

61.

Accession number: 20193607404591

Title: **Conform to the trend of reform and promote fairness and openness: An interpretation of a new version Measures for the Non-discriminatory Third-party Access Regulation of Oil and Gas Pipeline Network Facilities**

Authors: Guo, Haitao ; Zhou, Shuhui ; Zhao, Zhongde ; Liang, Yan ; Zhu, Feng ; Zhang, Qian

Author affiliation: China Petroleum Planning and Engineering Institute, Beijing; 100083, China

School of Public Policy and Management, Tsinghua University, Beijing; 100084, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: June 25, 2019

Publication year: 2019

Pages: 137-146

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: On 24 May 2019, National Development and Reform Commission, National Energy Agency, Ministry of Housing and Urban- Rural Construction and State Administration of Market Supervision and Administration jointly issued Measures for the Non-discriminatory Third-party Access Regulation of Oil and Gas Pipeline Network Facilities. This new version of Measures aims to further promote reform mechanisms and strengthen regulation and push forward more vigorously non-discriminatory third-party access facilities of oil and gas pipeline network, thus to better create an open and fair institutional environment. In view of this, based upon an analysis of the present status and the existing problems, we combed and interpreted the Measures and achieved the following highlights of its contents. (1) Put an emphasis on the principle of non-discrimination to guarantee non-discriminatory third-party access in open service; (2) Adjust the scope of regulation to make the policy-making more targeted; (3) Stimulate the infrastructure construction and interconnection to tamp the foundation of non-discriminatory third-party access; (4) Give impetus to information disclosure to

improve the scientificity, normativeness and transparency of non-discriminatory third-party access; (5) Standardize application requirements, optimize the procedure of acceptance, and set up the constraint mechanism based on service contract; (6) Implement energy measurement and valuation of natural gas to better adapt to international pipeline transport and trade; (7) Put forward many new measures like diversification of pipeline transportation services, balance mechanism, etc. to guide the fair, open and market-oriented development. Finally, some proposals were suggested for the required work after the implementation of this new version of Measures: to make the robust foundation of laws and regulations and formulate and perfect the supporting rules, to improve regulatory effectiveness and ensure policy implementation, to actively deal with the reform of operation mechanism of oil and gas pipeline network, and to fulfill the responsibility in the supervision of national pipeline network companies.

Number of references: 27

Main heading: Gas pipelines

Controlled terms: Commerce - Discriminators - Gases - Laws and legislation - Natural gas transportation - Natural gasoline plants - Public policy

Uncontrolled terms: Information disclosure - Interpretation - Marketization reform - Oil-and-Gas pipelines - Pipeline networks - Regulation - Third party access

Classification code: 513.2 Petroleum Refineries - 522 Gas Fuels - 713.3 Modulators, Demodulators, Limiters, Discriminators, Mixers - 971 Social Sciences

DOI: 10.3787/j.issn.1000-0976.2019.06.016

Database: Compendex

62.

Accession number: 20200208027888

Title: **High-pressure isothermal methane adsorption characteristic of Longmaxi Formation shale in the southern Sichuan Basin**

Title of translation: **川南地区龙马溪组页岩高压甲烷等温吸附特征**

Authors: Wang, Ximeng ; Liu, Luofu ; Wang, Yang ; Sheng, Yue

Author affiliation: State Key Laboratory of Petroleum Resource and Prospecting, China University of Petroleum, Beijing; 102249, China

College of Geosciences, China University of Petroleum, Beijing;

102249, China

Corresponding author: Liu, Luofu (liulf@cup.edu.cn)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 12

Issue date: December 25, 2019

Publication year: 2019

Pages: 32-39

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Accurate determination of gas content in shale is of great significance to the evaluation and the exploitation of shale gas reservoirs. At present, however, domestic and foreign scholars have different opinions on the model selection, adsorption mode and adsorption characteristics parameter in the isothermal adsorption experiment of shale methane, and the high-pressure isothermal methane adsorption characteristics are less researched. In this paper, the structural characteristics of the pores in the shale of Lower Silurian Longmaxi Formation were analyzed by conducting N2/CO2 low-pressure isothermal adsorption experiments. Then, gravimetric high-pressure isothermal methane adsorption experiments were carried out, and three different adsorption models (SDR, Langmuir and BET) were used to calculate the content of adsorbed methane. Finally, the methane adsorption characteristics of the samples were researched. And the following research results were obtained. First, as for the pores with a size of 0-50 nm, the distribution of specific surface area and pore volume is bimodal and trimodal, respectively. Compared with mesopores, micropores are higher in specific surface area and lower in pore volume and heterogeneity (D1<D2). Second, among the SDR, Langmuir and BET models, the average error of the first two models is both less than 6%. And methane molecules coexist in shale pores mainly in the adsorption form of monomolelcular layers and micropore filling. Third, in the case of high pressure and great burial depth, temperature is the main factor affecting the adsorption capacity and density of adsorbed methane. In the meantime, the density of the absorbed methane is also affected by thermodynamic parameter, pore structure and heterogeneity.

Fourth, methane molecules are mainly adsorbed in the micropores (0.4-0.8 nm) with higher absorption energy and larger specific area in the form of monomolecular layer in a low-pressure phase, and then most of them are adsorbed in micropores and mesopores (1.4-8.0 nm) in the coexistence form of micropore filling and monomolecular layer. In the high-pressure phase, few methane molecules are absorbed in mesopores and macropores in the pattern of multi-molecular layers.

Number of references: 26

Main heading: Methane

Controlled terms: Adsorption - Fractal dimension - Isotherms - Microporosity - Molecules - Petroleum reservoir evaluation - Petroleum reservoirs - Pore structure - Shale - Specific surface area

Uncontrolled terms: Average errors - High pressure - Methane adsorption - Sichuan Basin - Silurian

Classification code: 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 802.3 Chemical Operations - 804.1 Organic Compounds - 921 Mathematics - 931.2 Physical Properties of Gases, Liquids and Solids - 931.3 Atomic and Molecular Physics

Numerical data indexing: Percentage 6.00e+00%, Size 0.00e+00m to 5.00e-08m, Size 1.40e-09m to 8.00e-09m, Size 4.00e-10m to 8.00e-10m

DOI: 10.3787/j.issn.1000-0976.2019.12.004

Database: Compendex

63.

Accession number: 20193207285067

Title: **A new downhole acoustic wave generator and its acoustic propagation characteristics**

Authors: Wang, Qing ; Guan, Zhichuan ; Liu, Yongwang ; Zhang, Bo ; Li, Cheng

Author affiliation: School of Petroleum Engineering, China University of Petroleum <East China>, Qingdao; Shandong; 266580, China

Shandong Ultra-deep Drilling Process Control Tech R & D Center, Qingdao; Shandong; 266580, China

Petro-China Tarim Oilfield Company, Korla; Xinjiang; 841000, China

Corresponding author: Guan, Zhichuan (guanzhch@upc.edu.cn)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: May 25, 2019

Publication year: 2019

Pages: 107-114

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Effective generation of acoustic waves and efficient transmission of acoustic energy in the limited downhole space are prerequisites for the long-distance stable transmission of acoustic waves in drill strings, so an efficient and reliable generator is the key to the field application of downhole acoustic signal transmission technology. In order to realize the downhole information transmission of high speed, high accuracy and strong external factor immunity, we designed a downhole acoustic generator and it was manufactured based on the giant magnetostrictive transducer. Then, an experimental system was built up to study its functions and key parameters. And the following research results were obtained. First, a single-stage conical horn with an inner hole is the first choice for acoustic radiation, and the plane waves can be obtained by the transducer when the acoustic wave radiation enters the drill string from the small end of the conical horn. Second, the energy transfer efficiency of low frequency acoustic waves can be effectively improved when the horn length-diameter radio is designed near the minimum amplification coefficient point. Third, acoustic transfer medium made of copper has a higher filtering quality and transfer efficiency of acoustic energy. Fourth, the transfer efficiency of acoustic wave increases first and then remains unchanged with the increase of transducer pre-tightening force, and the optimal value is obtained at the pre-tightening force of 7.20 kN. In conclusion, the impact of transducer's acoustic radiation mode and structural parameters on the transfer efficiency of acoustic energy shall be fully considered during the design of the downhole acoustic generating and relaying device. And it is recommended to research further the effects of the mechanical structure of the acoustic emission end and the acoustic carrier parameters on the acoustic propagation characteristics in drill strings so as to speed up the field application of downhole acoustic signal

transmission technology.

Number of references: 20

Main heading: Acoustic wave propagation

Controlled terms: Acoustic emissions - Acoustic radiators - Acoustic wave transmission - Drill strings - Drills - Energy efficiency - Energy transfer - Infill drilling - Magnetostrictive devices - Transducers

Uncontrolled terms: Acoustic propagation - Experimental test - Generator - Horn - Influence law - Radiation mode - Structural parameter

Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 525.2 Energy Conservation - 603.2 Machine Tool Accessories - 751.1 Acoustic Waves - 751.2 Acoustic Properties of Materials - 752.1 Acoustic Devices

Numerical data indexing: Force 7.20e+03N

DOI: 10.3787/j.issn.1000-0976.2019.05.013

Database: Compendex

64.

Accession number: 20195107877741

Title: **Changing laws of wellbore temperature during offshore deepwater well drilling**

Title of translation: **海洋深水井钻井过程中井筒温度的变化规律**

Authors: Li, Zhonghui ; Zhao, Yi ; Lou, Yishan ; Li, Zhong ; Fang, Manzong ; Wei, Chenyu

Author affiliation: School of Petroleum Engineering, Yangtze University, Wuhan; Hubei; 430100, China

Lost Circulation Control Division, National Engineering Laboratory of Oil and Gas Drilling Technology, Wuhan; Hubei; 430100, China

CNOOC China Limited Zhanjiang Branch, Zhanjiang; Guangdong; 524057, China

Haidian Power Supply Company of Beijing Electric Power Company, State Grid, Beijing; 100086, China

Corresponding author: Zhao, Yi (zhaoyi9502@foxmail.com)

Source title: Natural Gas Industry

Abbreviated Natur. Gas Ind.

source title:
Volume: 39
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Issue date: October 25, 2019
Publication year: 2019
Pages: 88-94
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency

Abstract: When the existing calculation model of wellbore circulating temperature field is used to analyze the drilling process of offshore deepwater oil/gas wells, it takes into account the influence of many factors on the wellbore temperature (such as convection heat transfer of seawater, riser and drilling fluid, and formation heat conduction), but neglects the temperature difference caused by the drilling in actual fields. In order to provide more accurate and reliable data for related work in deepwater drilling, such as drilling fluid density design, borehole stability analysis, and so on, this paper calculated the temperature field using the temperature model for the process of circulating drilling fluid without drilling. Then, the calculation model of supplementary drilling condition was solved by means of the finite difference method and the Gauss iteration method. Finally, the influence of the drilling process with different rates of penetration on the longitudinal variation laws of wellbore temperature in deepwater wells was analyzed using the node updating algorithm. And the following research results were obtained. First, at the same depth, the calculated temperature fields of the whole well at different rates of penetration are obviously different, and the difference of the bottom hole temperature while drilling at a water depth of 1 000 m is close to 10 ℃. Second, in the process of drilling, the circulating temperature field is more sensitive to time than to the rate of penetration. And compared with the wellbore temperature field without considering the rate of penetration, the one with consideration of the rate of penetration presents a law of overall increase. It is concluded that by virtue of this new method, the practical problems in the process of offshore deepwater drilling can be analyzed better, e.g. borehole stability and pipe string working conditions, and the actual production can be reflected more accurately.

Number of references: 27

Main heading: Offshore oil wells

Controlled terms: Deepwater drilling - Drilling fluids - Finite difference method - Heat conduction - Heat convection - Infill drilling - Iterative methods - Marine risers - Offshore boreholes - Offshore oil fields - Offshore oil well production - Offshore pipelines - Oil field development - Oil field equipment - Oil well drilling - Temperature

Uncontrolled terms: Node upgrading - Offshore - Rate of penetration - Wellbore temperature - While drillings

Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 641.1 Thermodynamics - 641.2 Heat Transfer - 921.6 Numerical Methods

Numerical data indexing: Size 1.00e+03m

DOI: 10.3787/j.issn.1000-0976.2019.10.011

Database: Compendex

65.

Accession number: 20193907482141

Title: **The opinions on the implementation of reform of operational mechanism of petroleum and natural gas pipeline network**

Title of translation: **对于组建国家油气管网公司的思考及建议**

Authors: Bai, Jun ; Zhang, Xiongjun

Author affiliation: Beijing Gas Group Research Institute, Beijing; 100011, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Publication year: 2019

Pages: 127-132

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 14

Main heading: Gas industry

Controlled terms: Commerce - Gases - Gasoline - Investments - Natural gas - Natural gas pipelines - Natural gasoline plants - Petroleum industry - Public policy

Uncontrolled terms: China - Fair and open - Interconnection - Oil and gas - Oil-and-Gas pipelines - Proposal - Supervision

Classification code: 513.2 Petroleum Refineries - 522 Gas Fuels - 523 Liquid Fuels - 971 Social Sciences

DOI: 10.3787/j.issn.1000-0976.2019.07.017

Database: Compendex

66.

Accession number: 20194207561190

Title: **A layout process of natural gas pipeline network with the simultaneous optimization of failure probability and construction cost**

Title of translation: **同步优化失效概率与建设成本的天然气管网布局流程**

Authors: An, Jinyu ; Liu, Peng ; An, Jianbo

Author affiliation: College of Civil Engineering, Guizhou University, Guiyang; Guizhou; 550025, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: August 25, 2019

Publication year: 2019

Pages: 113-119

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 19

Main heading: Natural gas pipelines

Controlled terms: Backpropagation - Clustering algorithms - Natural gas - Neural networks - Probability - Soils - Trees (mathematics)

Uncontrolled terms: Construction costs - Failure Probability - Layout optimization - Minimum spanning trees - Normalization - Soil composition

Classification code: 483.1 Soils and Soil Mechanics - 522 Gas Fuels - 723.4 Artificial Intelligence - 903.1 Information Sources and Analysis - 921.4 Combinatorial Mathematics, Includes Graph Theory, Set Theory - 922.1 Probability Theory

DOI: 10.3787/j.issn.1000-0976.2019.08.014

Database: Compendex

67.

Accession number: 20193207284530

Title: **A newly fitted thermodynamic model for the capture of CO2 from flue gas by the hydrate method**

Authors: Li, Luling ; Zhao, Jinzhou ; Li, Haitao ; Zhang, Liehui ; Fan, Shuanshi ; Li, Qingping ; Pang, Weixin ; Lü, Xin ; Zheng, Lijun ; Wei, Na

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

MOE Key Laboratory of Heat Transfer Enhancement and Process Energy Conservation, South China University of Technology, Guangzhou; Guangdong; 510006, China

CNOOC Research Institute, Beijing; 100027, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 4

Issue date: April 25, 2019

Publication year: 2019

Pages: 104-110

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 39

Main heading: Gas hydrates

Controlled terms: Carbon dioxide - Drops - Energy utilization - Flue gases - Flues - Forecasting - Gases - Hydration - Phase equilibria - Thermodynamic properties - Van der Waals forces

Uncontrolled terms: CO2 capture - Energy parameters - Gas separations - Hydration reaction - Langmuir absorption - Thermodynamic model

Classification code: 451.1 Air Pollution Sources - 522 Gas Fuels - 525.3 Energy Utilization - 641.1 Thermodynamics - 801.4 Physical Chemistry - 804.2 Inorganic Compounds

Numerical data indexing: Percentage 1.52e+01% to 5.02e+00%, Percentage 1.84e+00% to 8.00e-02%, Percentage 4.06e+00% to 2.09e+00%, Percentage 8.20e-01%, Percentage 8.60e-01%

DOI: 10.3787/j.issn.1000-0976.2019.04.014

Database: Compendex

68.

Accession number: 20200208027934

Title: **An experimental study on the optimization of drilling fluid in offshore gas hydrate formations**

Title of translation: **海洋天然气水合物地层钻井液优化实验研究**

Authors: Qiu, Zhengsong ; Zhang, Yubin ; Zhao, Xin ; He, Qingshui ; Chen, Zengwei ; Zhao, Chao

Author affiliation: Key Laboratory of Unconventional Oil & Gas Development, China University of Petroleum - East China, Qingdao; Shandong; 266580, China

School of Petroleum Engineering, China University of Petroleum - East China, Qingdao; Shandong; 266580, China

Sinopec Research Institute of Petroleum Engineering, Beijing; 100101, China

ENN Energy Holdings Limited, Shanghai; 200120, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: December 25, 2019

Publication year: 2019

Pages: 104-109

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 18

Main heading: Gas hydrates

Controlled terms: Boreholes - Drilling fluids - Gases - Hydration - Infill drilling - Lecithin - Mass transfer - Methane - Offshore drilling - Offshore oil well production - Offshore technology - Temperature

Uncontrolled terms: Borehole stability - Decomposition characteristics - Heat and mass transfer - Hydrate decomposition - Hydrate formation - Peng-Robinson equations - Surface adsorption - Water based drilling fluids

Classification code: 511.1 Oil Field Production Operations - 522 Gas Fuels - 641.1 Thermodynamics - 641.3 Mass Transfer - 804.1 Organic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.12.013

Database: Compendex

69.

Accession number: 20200408064825

Title: **A new method of well-control high resolution processing for post-stack seismic data**

Title of translation: **叠后地震资料井控高分辨率处理新方法**

Authors: Wu, Dakui ; Wu, Zongwei ; Wu, Yijia

Author affiliation: Geological Exploration and Development Research Institute, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Pages: 36-43

Language: Chinese

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Increasing the resolution of seismic data has long been a major topic in seismic exploration. Due to the effect of high-frequency noises, traditional methods could only improve the resolution limitedly. To end this, this paper newly proposed a high-resolution seismic data processing method based on well-seismic combination after summarizing the research status on high resolution. Synthetic record and seismogram are similar in effective signals but dissimilar in noises. Their effective signals are regular and noises are irregular. And they are similar in adjacent frequency. Based on these "three-regularity" characteristics, the relationship between synthetic record and seismogram was established using the neural network algorithm. Then, the corresponding extrapolation algorithm was proposed based on the self-adaptive geological and geophysical variation of multi-layer network structure. And a model was established by virtue of this method and the theoretical simulation was carried out. In addition, it was tested from the aspects of frequency component and amplitude energy recovery, phase correction, regularity elimination and stochastic noise. And the following research results were obtained. First, this new method can extract high-frequency information as much as possible and remain middle and low-frequency effective information while eliminating the noises. Second, in this method, the idea of traditional methods to denoise first and then expand frequency is changed completely and the limitation of traditional methods is broken. It establishes the idea of expanding frequency and denoising simultaneously and increases the resolution to the uttermost. Third, this new method has been applied to a variety of reservoir descriptions and the high-resolution processing results have been improved significantly in precision and accuracy.

Number of references: 17

Main heading: Data handling

Controlled terms: Data processing - Network layers - Neural networks - Seismic prospecting - Seismic response - Seismic waves - Stochastic systems

Uncontrolled terms: De-noising - Frequency expanding - High resolution - Seismogram - Stack - Synthetic record

Classification code: 484 Seismology - 723 Computer Software, Data Handling and Applications - 723.2 Data Processing and Image Processing - 961 Systems Science

DOI: 10.3787/j.issn.1000-0976.2019.11.005

Database: Compendex

70.

Accession number: 20200408064915

Title: **Thermodynamic characteristics of CH4 adsorption by continental shale: A case study of the Upper Triassic Yanchang Shale in the Yanchang Gasfield, Ordos Basin**

Title of translation: **陆相页岩吸附CH4的热力学特征-以鄂尔多斯盆地延长气田上三叠统延长组页岩为例**

Authors: Xue, Pei ; Zhang, Lixia ; Liang, Quansheng ; Sun, Xining ; Zhao, Qianping ; Qi, Panwen

Author affiliation: Research Institute, Shaanxi Yanchang Petroleum <Group> Co., Ltd., Xi'an; Shaanxi; 710075, China

Shaanxi Key Laboratory of Lacustrine Shale Gas Accumulation and Exploitation, Xi'an; Shaanxi; 710075, China

Corresponding author: Zhang, Lixia (zlxcyq999@sina.com)

Source title: Natural Gas Industry

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 43

Main heading: Adsorption

Controlled terms: Chemical bonds - Exponential functions - Isotherms - Metamorphic rocks - Molecules - Petroleum reservoir evaluation - Shale gas - Temperature - Thermodynamics

Uncontrolled terms: Adsorption capacities - Isosteric heat of adsorption - Isothermal adsorption - Ordos Basin - Yanchang Gasfield

Classification code: 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 641.1 Thermodynamics - 801.4 Physical Chemistry - 802.3 Chemical Operations - 921 Mathematics - 931.3 Atomic and Molecular Physics

Numerical data indexing: Percentage 1.82e+01% to 4.98e+01%

DOI: 10.3787/j.issn.1000-0976.2019.11.008

Database: Compendex

71.

Accession number: 20194207561209

Title: **A simulation study on the influence of vent port strength on the natural gas explosion flow field in line pipes**

Title of translation: **泄爆口强度对管内天然气爆炸流场的影响仿真**

Authors: Wen, Hu ; Gao, Huihui ; Wang, Qiuhong ; Luo, Zhenmin ; Jiang, Juncheng ; Zhang, Mingguang

Author affiliation: School of Safety Science and Engineering, Xi'an University of Science and Technology, Xi'an; Shaanxi; 710054, China

Shaanxi Key Laboratory of Coal Fire Disaster Prevention and Control, Xi'an University of Science and Technology, Xi'an; Shaanxi; 710054, China

School of Safety Science and Engineering, Nanjing University of Technology, Nanjing; Jiangsu; 210009, China

Corresponding author: Wang, Qiuhong (wangqiuhong1025@126.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Publication year: 2019

Pages: 126-136

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 27

Main heading: Natural gas fields

Controlled terms: Combustion - Explosions - Flow fields - Methane - Natural gas - Pipelines - Pressure - Temperature - Vents

Uncontrolled terms: FLACS - Flame propagation speed - Flow field characteristics - Simulation - Strength of vent port

Classification code: 512.2.1 Natural Gas Fields - 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 631.1 Fluid Flow, General - 641.1 Thermodynamics - 804.1 Organic Compounds - 931.1 Mechanics

Numerical data indexing: Pressure 5.00e+05Pa

DOI: 10.3787/j.issn.1000-0976.2019.08.016

Database: Compendex

72.

Accession number: 20200208027960

Title: **Application of high-resolution remote sensing image to monitoring soil erosion in shale gas development**

Title of translation: **高分遥感影像在页岩气开发水土流失监测中的应用**

Authors: Du, Xianyuan ; Chen, Hongkun ; Weng, Yibin ; Ma, Liang ; Zhang, Kunfeng ; Xia, Liangzhi ; Dai, Jianlin ; Feng, Yang

Author affiliation: State Key Laboratory of Petroleum Pollution Control, Beijing; 102206, China

CNPC Research Institute of Safety and Environmental Technology, Beijing; 102206, China

PetroChina Zhejiang Oilfield Company, Hangzhou; Zhejiang; 310007, China

Beijing Datum Technology Development Co., Ltd., Beijing; 100084, China

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Abbreviated source title: Natur. Gas Ind.

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Issue date: December 25, 2019

Publication year: 2019

Pages: 161-167

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 21

Main heading: Remote sensing

Controlled terms: C (programming language) - Erosion - Gas industry - Gases - Geological surveys - Image resolution - Land use - Monitoring - Oil field development - Petroleum industry - Petroleum prospecting - Shale gas - Soil conservation - Soils - Time series analysis - Topography - Vegetation

Uncontrolled terms: Factor methods - High resolution remote sensing - Oil and gas exploration - Soil erosion - Vegetation coverage - Water and soil conservations

Classification code: 403 Urban and Regional Planning and Development - 481.1 Geology - 483.1 Soils and Soil Mechanics - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 723.1.1 Computer Programming Languages - 922.2 Mathematical Statistics - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.12.021

Database: Compendex

73.

Accession number: 20200208027946

Title: **Natural convection heat transfer characteristics of methane droplets in their vapor in the precooling process of an LNG tank**

Title of translation: **甲烷液滴在其蒸气中自然对流的换热特性**

Authors: Deng, Jiajia ; Hu, Youwu ; Lu, Jinshu ; Xu, Jian

Author affiliation: School of Port and Transportation Engineering, Zhejiang Ocean University, Zhoushan; Zhejiang; 316022, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39
Issue: 12
Issue date: December 25, 2019
Publication year: 2019
Pages: 116-123
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency
Number of references: 27
Main heading: Drops
Controlled terms: Boundary layers - Computational fluid dynamics - Cooling - Cryogenics - Evaporation - Liquefied natural gas - Methane - Natural convection - Nusselt number - Tanks (containers)
Uncontrolled terms: Calculation results - Droplet surfaces - Evaporation heat transfer - Evaporation model - Model calculations - Precooling process - Temperature boundary - Temperature differences
Classification code: 523 Liquid Fuels - 619.2 Tanks - 641.2 Heat Transfer - 644.4 Cryogenics - 723.5 Computer Applications - 802.3 Chemical Operations - 804.1 Organic Compounds
DOI: 10.3787/j.issn.1000-0976.2019.12.015
Database: Compendex

74.

Accession number: 20192607089034

Title: **Comprehensive geological modeling technology for shale gas reservoirs**

Title of translation: **页岩气藏综合地质建模技术**

Authors: Long, Shengxiang ; Zhang, Yongqing ; Li, Juhong ; Sun, Zhiyu ; Shang, Xiaofei ; Dai, Cheng

Author affiliation: Sinopec Key Laboratory of Shale Oil/Gas Exploration and Production Technology, Beijing; 100083, China

Sinopec Petroleum Exploration and Production Research Institute, Beijing; 100083, China

Paradigm Technology <Beijing> Co., Ltd., Beijing; 100004,

China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Issue date: March 25, 2019

Publication year: 2019

Pages: 47-55

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: At present, the technical ideas and implementation modes adopted in the geological modeling of shale gas reservoirs are mainly derived from those used in conventional oil and gas reservoirs, so they are not applicable to shale gas reservoirs. Moreover, there are few reports on the results of shale gas geological modeling at home and abroad. In view of this, a technical process of geological modeling for shale gas reservoirs was firstly established according to its particularity. Secondly, a structure and shale sublayer development model for the working area was established based on logging interpretation results, pre-stack and post-stack seismic interpretation data and geological test analysis results of samples. Thirdly, property models of shale gas reservoirs, including thickness, porosity, gas saturation, TOC, silicon content and brittleness index, were established using geostatistic modeling method in the frame model. Fourthly, a natural fracture DFN model was established using the object-based modeling method, based on seismic AFE attribute, structural curvature and strain and dilatation data, combined with geological knowledge and drilling display. Fifthly, a hydraulic fracture model was established based on the estimate of hydraulic fracture distribution pattern and the parameter fitting analysis. Finally, a comprehensive geological model for shale gas reservoirs was established by virtue of step-by-step superposition. What’ s more, it was applied to the production history matching and performance prediction of shale gas wells. And the following research results were obtained. First, the geological modeling of shale gas reservoirs is more complex than that of conventional oil and gas reservoirs, and the complexities are presented as difficult classification and correlation of sublayers, multiple matrix parameters restricting each other, diverse geneses and sizes of natural fractures, and

complicated distribution of hydraulic fractures under the interference and influence of natural fractures. Second, the natural fracture DFN model is capable of describing the geometrical shape and distribution of fracture system effectively and finely, and the hydraulic fracture model can better embody the distribution of hydraulic fractures and the stimulated reservoir volume (SRV). The establishment of the comprehensive geological model for shale gas reservoirs can be realized by progressively integrating and superposing the structure and sublayer development model, the multi-matrix property parameter model, the multi-scale natural fracture model and the hydraulic fracture model under the constraint of multi-scale natural fracture model. Third, production history matching results of gas wells show that the error of bottomhole pressure is lower than 3.3%, which indicates that the newly established comprehensive geological model of shale gas reservoirs is reliable. In conclusion, the modeling process and method developed in this paper can be used as reference in the establishment of a comprehensive geological model for shale gas reservoirs.

Number of references: 31

Main heading: Petroleum reservoirs

Controlled terms: Bottom hole pressure - Fracture - Fracture mechanics - Gas industry - Gases - Geologic models - Hydraulic fracturing - Matrix algebra - Natural gas well production - Natural gas wells - Petroleum reservoir engineering - Seismology - Shale gas

Uncontrolled terms: Fracture model - Geological modeling - Modeling technology - Property models - Shale gas reservoirs - Step-by-step integration

Classification code: 481.1 Geology - 484.1 Earthquake Measurements and Analysis - 512 Petroleum and Related Deposits - 522 Gas Fuels - 921.1 Algebra - 931.1 Mechanics - 951 Materials Science

Numerical data indexing: Percentage 3.30e+00%

DOI: 10.3787/j.issn.1000-0976.2019.03.006

Database: Compendex

75.

Accession number: 20192607089044

Title: **Current interference of HVDC ground electrode to buried pipelines and its personal safety distance**

Title of translation: 高压直流接地极对埋地管道的电流干扰及人身安全距离

Authors: Cao, Guofei ; Gu, Qinglin ; Jiang, Yongtao ; Li, Yongfa ; Mao, Jian ; Xiu, Linran ; Wang, Xiuyun ; Jiang, Zitao

Author affiliation: West-East Gas Pipeline Branch, PetroChina Pipeline Company, Shanghai; 200135, China

Safetech Research Institute, Beijing; 100083, China

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Publication year: 2019

Pages: 125-132

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: When DC ground electrode of a high-voltage direct current (HVDC) transmission system is in the stage of early operation or in the case of failures and maintenance, an instantaneous large current will be generated and bring great potential safety hazards to the nearby buried oil/gas pipelines and facilities and operators. In order to ensure the safety of the persons near the buried pipelines, we investigated the current interference of HVDC ground electrode to buried pipelines and its personal safety distance (hereinafter referred to as a safety distance). Firstly, the model simulating the electromagnetic interference to buried pipelines was established by means of the numerical simulation technology. Then, the model was used to calculate the safety distance corresponding to eddy current interference of HVDC ground electrode to buried pipelines under different soil resistivities, pipeline lengths, pipeline anti-corrosion insulations, earth currents of ground electrode and pipeline sizes. Finally, the influence laws of above mentioned factors on the interference degree of HVDC ground electrode were analyzed. And the following research results were obtained. First, the influence of pipeline length on the interference degree of HVDC ground electrode is great. The longer the pipeline, the greater the safety distance. When the pipeline is equal to or longer than 600 km, however, the safety distance is basically the same. Second, the effect of pipeline coating on the interference

degree of HVDC ground electrode is great. As the coating surface resistivity increases, the safety distance increases gradually. Third, for multi-layer soil structures, the maximum single-layer resistivity can be taken as the overall resistivity. And correspondingly, the calculated safety distance is the longest, and the evaluation result is more conservative. In conclusion, the safety distance diagrams of the pipelines with 4 lengths which are obtained based on the calculation results can be used as reference in the design of HVDC ground electrode and pipelines, as well as the basis for selecting the safety distance of HVDC ground electrode or buried pipelines to be constructed.

Number of references: 21

Main heading: Pipelines

Controlled terms: Coatings - Computer simulation - Eddy current testing - Electromagnetic pulse - Electromagnetic wave interference - Grounding electrodes - HVDC power transmission - Numerical models - Pipeline corrosion - Signal interference - Soils - Underground corrosion

Uncontrolled terms: Buried pipelines - Coating surface - Personal safety - Pipeline length - Soil resistivity

Classification code: 483.1 Soils and Soil Mechanics - 539.1 Metals Corrosion - 619.1 Pipe, Piping and Pipelines - 701 Electricity and Magnetism - 706.1.1 Electric Power Transmission - 711 Electromagnetic Waves - 716.1 Information Theory and Signal Processing - 723.5 Computer Applications - 813.2 Coating Materials - 921 Mathematics

Numerical data indexing: Size 6.00e+05m

DOI: 10.3787/j.issn.1000-0976.2019.03.016

Database: Compendex

76.

Accession number: 20192206992468

Title: **A price-system network of natural gas production, supply, storage, sales in China: Present status, problems and proposals**

Title of translation: **我国天然气产供储销价格体系: 现状, 问题与建议**

Authors: Zhang, Yong

Author affiliation: CNPC Financial Department, Beijing; 100007, China

Corresponding Zhang, Yong (zhangyong@petrochina.com.cn)

author:

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Issue date: January 25, 2019

Publication year: 2019

Pages: 131-137

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: A price-system network of natural gas production, supply, storage and sales, as the key and foundation to guarantee the longterm and stable supply of natural gas, has been completed in recent years with the overall thought of "Holding the Middle and Letting Go of Both Ends", i.e., on the one hand natural gas price marketization reform has been promoted; on the other hand such natural monopoly sections as transmission and distribution prices have been highly supervised. Although such achievements have been made, there are still many imperfections that need to be improved urgently, for this network does not meet the requirement of natural gas industry and market development. In view of this, based upon an overview of this network's present status, we analyzed and discussed the existing problems and put forward the corresponding proposals as follows. (1) As for the unresolved serious loss in gas imports, the gate prices of imported gas should be all opened to make those loss-making import enterprises survive; (2) An S-curve formula should be adopted to complete the benchmarking pricing formula of gate prices. (3) As for the dispute in the price floating policy, seasonal differential price policy should be promoted to complete the gas storage peak-shaving pricing mechanism. (4) The depreciation years of pipeline assets should be reasonably determined to decrease the transmission and distribution prices.

Number of references: 18

Main heading: Gas industry

Controlled terms: Commerce - Costs - Gases - Natural gas - Natural gas well production - Sales

Uncontrolled terms: Gas price - Gas storage - Gate price - Pricing systems - Suggestion

Classification code: 512.2.1 Natural Gas Fields - 522 Gas Fuels - 911 Cost and Value Engineering; Industrial Economics

DOI: 10.3787/j.issn.1000-0976.2019.01.016

Database: Compendex

77.

Accession number: 20192607089040

Title: **A calculation method for ultimate load of the gas line pipes with girth weld surface cracks**

Title of translation: **输气管道环焊缝表面裂纹管道极限载荷计算方法**

Authors: Wang, Xu ; Shuai, Jian

Author affiliation: College of Safety and Ocean Engineering, China University of Petroleum, Beijing; 102249, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 94-101

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In this paper, a finite element model with girth weld defects considering crack tip singularity was established in order to facilitate the accurate and rapid safety assessment on girth weld defects of long-distance gas line pipes. Then the J-integral of girth weld cracks in line pipes with different defect sizes was calculated, and the influence of weld matching coefficient and material hardening index on J-integral is analyzed. Furthermore, the factors affecting the limit load of pipelines with defects based on the J-integral theory were studied. Based on this, the engineering calculation formula which can calculate J-integral and limit load rapidly in the situations with specific matching

coefficient and material hardening index was proposed. And the following research results were obtained. First, the engineering calculation formula based on the fitting of finite element calculation results is of higher accuracy, and it can calculate the J-integral in the geometry range of large defects and the limit load of the pipes with girth weld cracks. Second, the J-integral of cracks in line pipes with girth weld defects is closely related to defect size, material properties and weld matching coefficient, and the limit load of pipes with defects decreases with the increase of crack size and increases with the increase of material hardening index. Third, for the X80 pipes with surface cracks at the centerline of the girth weld, the load carrying capacity of the line pipe with low-strength matched weld (matching coefficient < 20%) is lower than that with high-strength or equivalent-matched weld (matching coefficient > 20%). In conclusion, the research results can be used as reference for the safety evaluation and integrity management of in-service gas pipelines.

Number of references: 20

Main heading: Welds

Controlled terms: Crack tips - Cracks - Gas pipelines - Hardening - Pipelines - Safety engineering - Structural loads - Surface defects

Uncontrolled terms: Defect size - Fast solutions - Girth weld defects - J integral - Limit Load - Safety assessments

Classification code: 408.1 Structural Design, General - 537.1 Heat Treatment Processes - 538.2 Welding - 619.1 Pipe, Piping and Pipelines - 914 Safety Engineering - 951 Materials Science

Numerical data indexing: Percentage 2.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.03.012

Database: Compendex

78.

Accession number: 20192607089032

Title: **New parameters for quantitative evaluation of gas-bearing property of natural gas reservoirs**

Title of translation: **天然气储层含气性定量评价新参数**

Authors: Wang, Xiuchao

Author affiliation: Geology Research Institute of CNPC Great Wall Drilling Company, Panjin; Liaoning; 124010, China

Corresponding Wang, Xiuchao (wangxc.gwdc@cnpc.com.cn)

author:

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 32-37

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Productivity evaluation of natural gas reservoirs is an important part of comprehensive reservoir logging interpretation. However, the currently adopted gas saturation cannot effectively characterize the gas-bearing property of natural gas reservoirs. In this paper, the limitations of gas saturation in the evaluation of natural gas reservoir productivity were analyzed. Then, based on the quantity of natural gas and the ideal gas state equation, a new parameter for quantitative evaluation of the gas-bearing property of reservoirs was proposed, i.e., relative molar volume of gas, and its determination method were provided. Finally, logging evaluation was carried out on a certain well in the tight sandstone gas reservoir of the Sulige Gas Field in the Ordos Basin. What' s more, its relative molar volume of gas was calculated, and the application effect was analyzed. And the following research results were obtained. First, the relative molar volume of gas is controlled jointly by porosity, saturation, pore pressure and natural gas compressibility factor, and the accurate calculation of pore pressure and natural gas compressibility factor is the core of determining the relative molar volume of gas. Second, there is no one-to-one corresponding relationship between the gas saturation of a reservoir and its gas-producing capacity. In some conditions, reservoirs with high gas saturation are not always productive. On the contrary, reservoirs with relatively moderate gas saturation may also be highly productive. Third, the relative molar volume of gas can precisely reflect the absolute gas content of a reservoir. In addition, its application in identifying the gas-bearing level of a reservoir is remarkable, and its value can directly indicate the gas-bearing property of a reservoir. In conclusion, the research results provide a new idea for the comprehensive interpretation of natural gas logging.

Number of references: 20

Main heading: Compressibility of gases

Controlled terms: Density of gases - Equations of state - Gas bearings - Gases - Natural gas - Natural gas well logging - Oil bearing formations - Parameter estimation - Petroleum reservoir evaluation - Petroleum reservoirs - Pore pressure - Productivity - Volume measurement

Uncontrolled terms: Bearing properties - Gas compressibility factors - Gas saturations - Natural gas reservoir - Quantitative evaluation

Classification code: 483.1 Soils and Soil Mechanics - 512 Petroleum and Related Deposits - 522 Gas Fuels - 601.2 Machine Components - 931.2 Physical Properties of Gases, Liquids and Solids - 943.2 Mechanical Variables Measurements

DOI: 10.3787/j.issn.1000-0976.2019.03.004

Database: Compendex

79.

Accession number: 20192607089042

Title: **Sulfide control indexes and treatment measures in gas field water**

Title of translation: **气田水中硫化物控制指标及处理措施**

Authors: Weng, Banghua ; Yang, Jie ; Chen, Changjie ; Xu, Xuan ; Wang, Ying ; Gao, Xiaogen

Author affiliation: Institute of Safety, Environment Protection and Technical Supervision, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

National Energy R&D Center of High-Sulfur Gas Reservoir Exploitation, Chengdu; Sichuan; 610213, China

Natural Gas Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Sichuan Tianyu Petroleum Environment Protection Technology Consulting Service Co., Ltd., Chengdu; Sichuan; 610041, China

Research Institute of Exploration and Development, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Gas field water produced from sour gas fields contains sulfides to varying degrees, which can not only corrode pipelines, gas field water treatment equipment, injection wellbore, etc., but also bring safety risks when the sulfides escape in the form of hydrogen sulfide with the change of temperature, pressure or pH values. In order to control the sulfide content of gas field water and satisfy the requirements of safe and clean development of gas fields, we investigated the content and treatment status of sulfides in gas field water produced from sour gas fields in Sichuan and Chongqing areas. Then, the escape laws of hydrogen sulfide from sour gas field water with typical concentration were simulated, calculated and experimentally verified. Finally, the sulfide control indexes and treatment measures in gas field water were recommended. And the following research results were obtained. First, gas field water with a sulfide content higher than 200 mg/L shall be stored, transported and treated in a completely sealed environment to meet the safety, occupational health and environmental requirements of a workplace. Second, the content of sulfides in the re-injected gas field water shall be controlled below 20 mg/L to minimize sulfide corrosion on ground facilities, transmission pipelines and injection wellbores and keep the content of escaping hydrogen sulfide under an unsealed condition far lower than the limit values of occupational health contact and environment emission stipulated in national standards. Third, the desulfurization process used for sour gas field water shall take full consideration of the sulfur-bearing characteristics and treatment objective of gas field water. And it is necessary to select one-stage or multi-stage desulfurization process based on operation economy and reliability, so as to realize efficient and economical desulfurization.

Number of references: 18

Main heading: Oil field equipment

Controlled terms: Boreholes - Desulfurization - Evaporation - Gases - Hydrogen sulfide - Hydrogen sulfide removal (water

treatment) - Industrial hygiene - Pipeline corrosion - Pipelines - Sour gas - Stages - Sulfur compounds - Sulfur determination - Water treatment

Uncontrolled terms: Content - Control index - Gas field water - Sulfide - Treatment measures

Classification code: 402.2 Public Buildings - 445.1 Water Treatment Techniques - 461.7 Health Care - 511.2 Oil Field Equipment - 512.2 Natural Gas Deposits - 619.1 Pipe, Piping and Pipelines - 801 Chemistry - 802.3 Chemical Operations - 804.2 Inorganic Compounds

Numerical data indexing: Mass_Density 2.00e-01kg/m3

DOI: 10.3787/j.issn.1000-0976.2019.03.014

Database: Compendex

80.

Accession number: 20192206992460

Title: **Fracture initiation & propagation in shale due to imbibition during well shut-in after fracturing: A case study from one well platform in Longmaxi Fm of the Changning Block, Sichuan Basin**

Title of translation: **压裂后焖井期间页岩吸水起裂扩展研究-以四川盆地长宁区块龙马溪组某平台井为例**

Authors: Han, Huifen ; Yang, Bin ; Peng, Junliang

Author affiliation: Engineering Technology Research Institute, PetroChina Southwest Oil & Gasfield Company, Guanghan; Sichuan; 618300, China

Sichuan Key Laboratory of Shale Gas Evaluation and Exploitation, Chengdu; Sichuan; 610091, China

State Key Laboratory for Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to determine the soak time of shale gas wells after fracturing, it is necessary to predict the influence of shale's fracturing fluid imbibition capacity on the fracture initiation and propagation under reservoir conditions during well shut-in. In this paper, according to the fracture closure criterion, the closure state of fracture was analyzed based on the triaxial stress test results of Changning Block. Then, the maximum circumferential stress and the maximum effective shear stress under tensile failure and shear failure were calculated according to the tensile and shear initiation criteria of open fracture. And combined with the results of the triaxial and uniaxial compressive strength tests and the uniaxial Brazilian splitting tensile strength test, the threshold pressure of fracture initiation was obtained. Finally, the reasonable soak time of shale gas wells in the Longmaxi Fm of Lower Silurian in Changning Block, Sichuan Basin was discussed. And the following research results were obtained. First, after the fracturing of shale gas well in the Longmaxi Fm in Changning Block, the micro-fractures in the reservoir remain open during well shut in. Second, the stress state of the fractures under reservoir conditions is very complicated, and even the open fractures may suffer shear failure. Third, when the fracture dip is 0°, the maximum circumferential stress value is obtained at the fracture tip, and the corresponding fracture initiation angle is 0°, which means that fracture initiation and propagation will be along the direction of the maximum horizontal principal stress, and that when the fluid pressure inside the fracture is lower than 70 MPa, tensile fracturing will not happen any longer. Fourth, when the fracture dip is 0°, the corresponding maximum effective shear stress is, obtained and the fracture initiation angle is 55°. When the fluid pressure inside the fracture is lower than 60 MPa, shear fracturing will not occur any longer. Fifth, if full play should be given to the stimulation effect of fracturing fluid during well shut-in after fracturing, the reasonable soak time after fracturing in the Longmaxi Fm of the Changning Block shall be 5-10 days.

Number of references: 19

Main heading: Well stimulation

Controlled terms: Compressive strength - Fracturing fluids - Hydraulic fracturing - Natural gas wells - Shale gas - Shear stress - Tensile strength

Uncontrolled Changning Block - Fracture initiation - Fracture initiation

terms: angles - Shear failure - Sichuan Basin - Silurian - Soak time - Threshold pressures

Classification code: 512.1.2 Petroleum Deposits : Development Operations - 512.2.1 Natural Gas Fields - 522 Gas Fuels

Numerical data indexing: Age 1.37e-02yr to 2.74e-02yr, Pressure 6.00e+07Pa, Pressure 7.00e+07Pa

DOI: 10.3787/j.issn.1000-0976.2019.01.008

Database: Compendex

81.

Accession number: 20193607404637

Title: **Characteristics and genesis of the Ordovician Kelimoli dolomite reservoirs in the western edge of the Ordos Basin**

Authors: Wu, Dongxu ; Sun, Liuyi ; Zhou, Jingao ; Wu, Xingning ; Huang, Zhengliang ; Ding, Zhenchun ; Liu, Lei

Author affiliation: PetroChina Hangzhou Research Institute of Geology, Hangzhou; Zhejiang; 310023, China

CNPC Key Laboratoryof Carbonate Reservoirs, Hangzhou; Zhejiang; 310023, China

Research Institute of Exploration & Development, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710061, China

PetroChina Southern Petroleum Exploration and Development Company, Guangzhou; Guangdong; 510240, China

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Abbreviated source title: Natur. Gas Ind.

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ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In the Ordos Basin, the Ordovician developed multi-stage platform edge reefs and beach deposits. The thick and massive dolomite of the Zhuozishan Fm of Middle Ordovician has been

widely studied, but the thin-medium dolomite of the Kelimoli Fm of Middle Ordovician is seldom studied. Based on outcrop, core, thin section observation and well logging interpretation results, and through the analysis of the development background of reservoir of the Kelimoli Fm in this area, the petrological characteristics, pore structure characteristics, reservoir physical properties and geochemical characteristics of the Kelimoli Fm were studied. Based on the data of carbon and oxygen isotopes, strontium isotopes, rare earth elements, trace elements and cathode luminescence etc., the dolomite genesis and reservoir genesis models in this area were confirmed, and the dolomite reservoir distribution of the Kelimoli Fm in this area was predicted. The results indicate that: (1) there are three types of dolomite reservoirs in the Kelimoli Fm: intercrystalline pore, dissolution pore and cave, and fracture. The pore throats of intercrystalline pores and dissolution pores and caves which are the main reservoirs are evenly distributed with better porosity and permeability; (2) the main dolomite reservoir of the Kelimoli Fm is mainly formed by shallow burial metasomatism, and part of it has undergone deep burial hydrothermal transformation during the later stage; (3) high-frequency sequence and buried dolomitization control the reservoir development of the Kelimoli Fm. Hereinto, the ancient sedimentary terrain formed by tectonic movement controls the planar distribution of the beach, while the short-term fluctuation of sea level controls the longitudinal difference of the reservoir, and buried dolomitization strengthens the rock skeleton and pore preservation. It is concluded that the discontinuous dolomite reservoir of the Kelimoli Fm in this area is mainly distributed along the platform edge in an SN direction, with a thickness of 0.8-43.0 m and a total area of 6 512 km, which makes it possible to form an effective scale reservoir.

Number of references: 28

Main heading: Petroleum reservoir engineering

Controlled terms: Beaches - Dissolution - Exploratory geochemistry - Isotopes - Metamorphic rocks - Pore structure - Rare earths - Reefs - Sea level - Sedimentary rocks - Trace elements - Well logging

Uncontrolled terms: Dolomite - Dolomitization - High frequency HF - Ordos Basin - Ordovician - Reservoir characteristic - Reservoir prediction

Classification code: 407.3 Coastal Engineering - 471.1 Oceanography, General - 481.1 Geology - 481.2 Geochemistry - 482.2 Minerals - 512.1.2 Petroleum Deposits : Development Operations - 802.3 Chemical Operations - 804.2 Inorganic Compounds - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Area 6.51e+09m2, Size 8.00e-01m to 4.30e+01m

DOI: 10.3787/j.issn.1000-0976.2019.06.006

Database: Compendex

82.

Accession number: 20193207285065

Title: **Hydrocarbon accumulation of composite-buried hill reservoirs in the western subsag of Bozhong Sag, Bohai Bay Basin**

Authors: Xie, Yuhong ; Luo, Xiaoping ; Wang, Deying ; Xu, Chunqiang ; Xu, Yunlong ; Hou, Mingcai ; Chen, Anqing

Author affiliation: China National Offshore Oil Corp., Beijing; 100010, China

State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation//Chengdu University of Technology, Chengdu; Sichuan; 610059, China

College of Energy Resources, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

Institute of Sedimentary Geology, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

Corresponding author: Luo, Xiaoping (lxpzyyt@163.com)

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Publication year: 2019

Pages: 15-24

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: There are abundant hydrocarbon resources in the western subsag of Bozhong sag in the Bohai Bay Basin, where oil-gas discoveries have been made in those shallow Neogene and Paleogene reservoirs and deep Mesozoic buried hill reservoirs, but no better understandings have yet been achieved in terms

of the process of hydrocarbon accumulation and the relationship between deep buried hill reservoirs and the allocation of shallow reservoirs. Based on the organic geochemical analysis of source rocks and basin modeling of hydrocarbon generation evolution, distribution characteristics of fluid inclusion and homogeneous temperature measurement, combined with the characteristics of oil-source biomarkers, the process of hydrocarbon accumulation in this study area was resumed based upon the regional tectonic background. The following findings were obtained. (1) There are 3 sets of source rocks in the third and first members of Paleogene Shahejie Fm, and the second lower member of Paleogene Dongying Fm; the reservoirs in the peripheral uplift zones include Mesozoic volcanic rocks, Archean metamorphic rocks, and Paleogene-Neogene delta-fluvial porous sandstones. Hydrocarbon generated in this sag migrated along the fault unconformity surface to the slope before accumulated in the peripheral tectonic zones, resulting in 3 sets of source-reservoir-caprock assemblages formed with the characteristics of reservoir formation in compound oil and gas accumulation zones. (2) The stratum in the third member of Shahejie Fm is the main source rock. (3) The above three assemblages went through four periods of generating process during the geological time of 11-1 Ma. Vertically hydrocarbon sources first filled in the deep Mesozoic and Archean reservoirs, then migrated and accumulated in the shallow Neogene and Paleogene reservoirs, where multiple shore-term rapid filling of high-temperature fluids led to this typical oil and gas pooling mode.

Number of references: 25

Main heading: Petroleum reservoir engineering

Controlled terms: Analytical geochemistry - Hydrocarbons - Metamorphic rocks - Petroleum reservoirs - Tectonics - Temperature measurement - Volcanic rocks

Uncontrolled terms: Allocation relationship - Bohai Bay Basin - Buried hill - Hydrocarbon reservoir - Mesozoic - Oil and gas reservoir - Oil-source correlation - Western subsag of Bozhong sag

Classification code: 481.1 Geology - 482.2 Minerals - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 801 Chemistry - 804.1 Organic Compounds - 944.6 Temperature Measurements

Numerical data indexing: Age 1.10e+07yr to 1.00e+06yr

DOI: 10.3787/j.issn.1000-0976.2019.05.002

Database: Compendex

83.

Accession number: 20194807753805

Title: **Control action of faults on the sweet spots of tight sandstone gas reservoir: A case study of the second Member of Xujiahe gas reservoir in the Penglai area, Central Sichuan Basin**

Title of translation: **断层对致密砂岩气藏甜点区的控制作用--以四川盆地中部蓬莱地区须二段气藏为例**

Authors: Che, Guoqiong ; Wang, Li'en ; Wang, Hongjing ; Li, Ming ; Tang, Qingsong ; Tang, Song ; Liang, Feng ; Zeng, Qinggao

Author affiliation: Central Sichuan Division, PetroChina Southwest Oil & Gasfield Company, Suining; Sichuan; 629000, China

Northwest Sichuan Division, PetroChina Southwest Oil & Gasfield Company, Jiangyou; Sichuan; 621741, China

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Volume: 39

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Publication year: 2019

Pages: 22-32

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The Xujiahe Formation of Upper Triassic in the central Sichuan Basin is an extensive low-abundance tight sandstone gas reservoir with large-scale natural gas reserves, but its production difficulty is high and development benefit is low. In order to improve its development benefit, it is in urgent need to solve the technical difficulty of predicting and precisely characterizing sweet spots. In this paper, the gas reservoir of the second Member of Xujiahe Formation in the Penglai area of the Central Sichuan Basin was taken as an example. Firstly, the reservoir characteristics and the geological control factors of gas well productivity were summarized. Then, the geological characteristics and seismic response characteristics of three types of faults were defined, and their control action on sweet spots was investigated. Finally, combined with the seismic processing results, the sweet spots in the second Member of Xujiahe Formation in the Penglai area were characterized precisely. What's more, the application effect and prospect of

this achievement were analyzed. And the following research results were obtained. First, the reservoir in the second Member of Xujiahe Formation in the Penglai area is a low-porosity and extra-low-permeability tight sandstone reservoir and its matrix sandstones are poor in preserving and permeating quality, so the fault-associated fracture is the key factor of high gas yield. Second, in the Xujiahe Formation are developed NW striking reverse faults, which are mainly formed in the Yanshan period and overlapped and finally shaped in the Himalayan period. Third, all faults disappear downward in the Leikoupo Formation. And based on the upward disappearance horizons, the faults are divided into three types. These three types of faults are obviously different in reservoir control effects. Fourth, type I fault disappears upward in the principal producing pay, i.e., the third Submember of second Member of Xujiahe Formation, and its reworking effect on tight sandstones is significantly superior to the other two types of faults. The abnormal development belt of its associated fracture ranges in width from several hundred to several thousand meters. Its controlled hydrocarbon accumulation system of the third Submember of second Member of Xujiahe Formation is optimally matched in the hydrocarbon accumulation elements of source rock, reservoir and cap rock. It controls hydrocarbon enrichment and high yield. Fifth, the fault-controlled fracture development belt presents abnormal characteristics in the conventional seismic section, e.g. bad break and chaotic waveform in the large area. Sixth, there are 17 sweet spots of reservoir body under the control of type I faults, which cover an area of 32.96 km and have an estimated gas in place of 82.4×10 m. In conclusion, the research result provides support for the following well deployment in the gas reservoir of the second Member of Xujiahe Formation in the Penglai area, presenting a promising application prospect.

Number of references: 19

Main heading: Low permeability reservoirs

Controlled terms: Faulting - Fracture - Gases - Hydrocarbon refining - Hydrocarbons - Natural gas - Natural gas well production - Petroleum reservoir engineering - Proven reserves - Sandstone - Seismology - Tight gas

Uncontrolled terms: Central Sichuan Basin - Fractured-porous reservoirs - Late Triassic - Penglai area - Sweet spot - Tight sandstone gas

Classification code: 482.2 Minerals - 484.1 Earthquake Measurements and Analysis - 512 Petroleum and Related Deposits - 513.1 Petroleum Refining, General - 522 Gas Fuels - 804.1 Organic Compounds - 951 Materials Science

Numerical data indexing: Area 3.30e+07m2

DOI: 10.3787/j.issn.1000-0976.2019.09.003

Database: Compendex

84.

Accession number: 20193607404674

Title: **Mechanical performance of acid corrosion of G3 nickel-base alloy tubings at high temperature and pressure**

Authors: Zhang, Zhi ; Zhou, Zeyu ; Song, Chuang ; Sang, Pengfei ; Liu, Hexing ; Li, Lei

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

CNOOC Zhanjiang Branch Company, Zhanjiang; Guangdong; 075900, China

Corresponding author: Song, Chuang (songc_Email@163.com)

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Pages: 107-114

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ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In the development of low-permeability oil and gas fields with high temperature, high pressure (HTHP), and high acid gas content, the general approach is acid stimulation through an integrated pipe string. In some oil and gas wells, frequent pipe string failures occur during acidification and production. For the purpose of analyzing the corrosion behavior of tubulars in acid environments and the causes of mechanical performance degradation, HTHP circular flow testers were used together with metallurgical microscopy, scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), and mechanical performance testing technologies; weight loss experiments and

mechanical performance tests were carried out in HTHP kettles for corrosion evaluations and tensile mechanical performance testing on commonly-used P110 tubulars and G3 nickel-base alloy tubulars to evaluate the corrosion degree, corrosion behavior, and mechanical performance change rules of these tubulars during oil and gas production and under different acid conditions. The study results are as follows. (1) During oil and gas production and under different acid conditions, the corrosion rate of nickel-base alloy is much lower than that of carbon steel. (2) With the increase of acid density, the corrosion rates of both nickel-base alloy and carbon steel increase and are greater than 0.076 mm/a which is specified in the NACE Standard RP0775-2005. (3) With the increase of acid density, the number of corrosion pits increases and the corrosion product film becomes thicker on the surface of the nickel-base alloy; and the corrosion product film falls off from the surface of alloy samples in 10% and 20% acids. (4) The mechanical performance of the acidized carbon steel and nickel-base alloy degrades, which becomes more significant as the acid concentration and acid treatment time increase. The degradation of the nickel-base alloy is more significant than that of the carbon steel. The following conclusions are made. (1) Acid treatment should be conducted by separate acidizing string and production string, or the acid time should be properly controlled to avoid pipe string corrosion. (2) Nickel-base alloy tubulars are recommended for exploitation.

Number of references: 15

Main heading: Nickel alloys

Controlled terms: Acidization - Corrosion rate - Corrosive effects - Energy dispersive spectroscopy - Gas industry - Gas permeability - Gas permeable membranes - Gases - High temperature corrosion - Low permeability reservoirs - Natural gas well production - Oil field development - Oil well production - Photodegradation - Pipeline corrosion - Scanning electron microscopy - Steel corrosion - Tensile testing - Tubing

Uncontrolled terms: Acid corrosion - Acid gas - Mechanical performance - Nickel base alloys - Oil and gas fields

Classification code: 511.1 Oil Field Production Operations - 512 Petroleum and Related Deposits - 522 Gas Fuels - 539.1 Metals Corrosion - 548.2 Nickel Alloys - 619.1 Pipe, Piping and Pipelines - 802.2 Chemical Reactions - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Percentage 1.00e+01%, Percentage 2.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.06.012

Database: Compendex

85.

Accession number: 20194807753640

Title: **Discussion on the management strategies of China's gas storage companies after pipeline network independence**

Title of translation: **管网独立后我国储气库公司的经营策略探讨**

Authors: Su, Kehua ; Li, Wei ; Xin, Jing ; Kou, Zhong

Author affiliation: Sinopec Exploration & Production Research Institute, Beijing; 100083, China

JLC Network Technology Co., Ltd., Beijing; 100029, China

Source title: Natural Gas Industry

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Pages: 132-139

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 15

Main heading: Underground gas storage

Controlled terms: Costs - Management - Natural gas - Natural gasoline plants - Pipelines - Rating - Storage management

Uncontrolled terms: Business and management - Existing problems - Financial independence - Gas storage - Management strategies - Management systems - Pipeline networks - Supervision

Classification code: 513.2 Petroleum Refineries - 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 723.3 Database Systems - 911 Cost and Value Engineering; Industrial Economics - 912.2 Management

DOI: 10.3787/j.issn.1000-0976.2019.09.017

Database: Compendex

86.

Accession number: 20200408064865

Title: **Experiments on the drag reduction effect of an open-hole packer with sand dredging grooves**

Title of translation: **含疏砂槽结构的裸眼封隔器减阻效果实验**

Authors: Li, Zifeng ; Song, Guangming ; Yang, Junwei ; Zhang, Chaoyue

Author affiliation: Petroleum Engineering Institute, Yanshan University, Qinhuangdao; Hebei; 066044, China

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Language: Chinese

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In the process of staged fracturing in an open-hole horizontal well, an open-hole packer contacts the cuttings bed when it goes down to the open-hole horizontal section. As a result, the running friction resistance is increased gradually. And on the other hand, the cuttings accumulated in front of the packer tend to result in sand sticking and wear the packer rubber, which may lead to the deterioration of setting performance and the failure of the packer. In this regard, this paper designed and manufactured a simulation experiment device to research the effect of the cuttings on the running process of the packer into the open-hole horizontal sections. Then, based on the experimental results, the original packer was structurally improved and sand dredging grooves applied to an open-hole packer was designed. And the following experimental results were obtained. First, in the process of running into the hole, the open-hole packer is supported by the cuttings pile to contact the upper wall, resulting in a sharp increase of friction resistance and then sand sticking. And the friction resistance applied on the packer increases with the increase of running displacement

and cuttings content. Second, after the packer is equipped with the structure of the sand dredging groove, cuttings flow through the sand dredging groove. As a result, the cuttings accumulation in front of the packer and the friction resistance on the packer running through the hole are reduced, and consequently the wear of packer rubber is diminished. Third, the number of sand dredging grooves in the improved packer model has a significant effect on sand dredging and friction reduction. In this experiment, the sand dredging effect is the best when the number of sand dredging grooves is up to 5. In conclusion, the research results provide a research idea and laboratory experiment basis for the further structure optimization of open-hole packers.

Number of references: 15

Main heading: Packers

Controlled terms: Deterioration - Friction - Horizontal wells - Piles - Rubber - Sand - Structural optimization - Wear of materials

Uncontrolled terms: Cuttings beds - Friction reduction - Friction resistance - Horizontal section - Laboratory experiments - Open holes - Sand dredging - Structure optimization

Classification code: 408.2 Structural Members and Shapes - 483.1 Soils and Soil Mechanics - 511.2 Oil Field Equipment - 512.1.1 Oil Fields - 818.1 Natural Rubber - 921.5 Optimization Techniques - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.11.012

Database: Compendex

87.

Accession number: 20194207561203

Title: **A new method for well pattern density optimization and recovery factor evaluation of tight sandstone gas reservoirs**

Title of translation: **致密砂岩气藏井网密度优化与采收率评价新方法**

Authors: Gao, Shusheng ; Liu, Huaxun ; Ye, Liyou ; Wen, Zhijie ; Zhu, Wenqing ; Zhang, Chun

Author affiliation: CNPC Science and Technology Research Institute, Beijing; 100083, China

Department of Porous Flow and Fluid Mechanics, PetroChina Research Institute of Petroleum Exploration & Development, Langfang; Hebei; 065007, China

Exploration and Development Research Institute, PetroChina

Jilin Oilfield Company, Songyuan; Jilin; 138000, China

Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610000, China

Corresponding author: Liu, Huaxun (liuhuaxun@petrochina.com.cn)

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Publication year: 2019

Pages: 58-65

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: For the sake of improving the reliability of the method for well pattern density optimization of tight sandstone gas reservoir and effectively demonstrate the relationship between well pattern density and recovery factor, the well interference probability curve of the target study area in the Sulige Gas Field was plotted by establishing the calculation method for well interference probability. Then, a new method suitable for well pattern density optimization and recovery factor evaluation of tight sandstone gas reservoirs was established. Finally, this new method was applied in three encryption test areas of the Sulige Gas Field. And the following research results were obtained. First, the well interference probability of tight sandstone gas reservoir is heavily dependent on the well pattern density. With the increase of the well pattern density, the well interference probability presents a gradual increasing trend. And the well interference probability doesn't reach or approach to 1 until the well pattern density reaches a higher value. Second, in the three encryption test areas of the Sulige Gas Field, the economically optimal well pattern density is in the range of 2.6-3.1 wells/km, and its corresponding recovery factor is 36.6%-39.8% and corresponding well interference probability is 28%-33%, while the economic limit well pattern density is in the range of 5.2-6.6 wells/km, and its corresponding recovery factor is 46.8%-49.8% and corresponding well interference probability is 83%-89%. Third, the well interference probability corresponding to the economically optimal well pattern density of tight sandstone gas

reservoir in the Sulige Gas Field is about 30%, and that corresponding to the economic limit well pattern density is about 85%. In conclusion, by virtue of this new method, the economically optimal well pattern density and the economic limit well pattern density and their corresponding recovery factors can be calculated, so as to realize the well pattern optimization and recovery factor evaluation of tight sandstone gas reservoirs. The research results can provide theoretical support for the economic and efficient development of the Sulige Gas Field, and useful reference for the benefit development of the same type of gas reservoirs.

Number of references: 23

Main heading: Petroleum reservoir evaluation

Controlled terms: Cryptography - Curve fitting - Density of gases - Gas industry - Gases - Petroleum reservoirs - Probability - Recovery - Sandstone - Tight gas

Uncontrolled terms: Interference probability - Ordos Basin - Recovery factors - Sulige gas field - Tight sandstone gas - Well patterns

Classification code: 482.2 Minerals - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 921.6 Numerical Methods - 922.1 Probability Theory - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Percentage 2.80e+01% to 3.30e+01%, Percentage 3.00e+01%, Percentage 3.66e+01% to 3.98e+01%, Percentage 4.68e+01% to 4.98e+01%, Percentage 8.30e+01% to 8.90e+01%, Percentage 8.50e+01%

DOI: 10.3787/j.issn.1000-0976.2019.08.007

Database: Compendex

88.

Accession number: 20200208027961

Title: **A prediction model for the gas threshold pressure gradients of water drive gas reservoirs**

Title of translation: **水驱气藏气相阈压梯度预测模型**

Authors: Li, Jiqiang ; Yang, Shenyao ; Qi, Zhilin ; Yan, Wende ; Yuan, Yingzhong ; Huang, Xiaoliang

Author affiliation: Chongqing Key Laboratory of Exploration and Development of Complex Oil and Gas Fields, Chongqing University of Science & Technology, Chongqing; 401331, China

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Pages: 66-73

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The existing prediction models for gas threshold pressure gradients can not accurately describe the variation of gas threshold pressure gradients with gas continuity. In order to solve this problem, this paper improved the experimental process of gas threshold pressure gradients. Based on this, the standard cores of a carbonate reservoir of Lower Triassic Feixianguan Formation in the Puguang Gas Field of the Sichuan Basin were selected for the experiment of gas threshold pressure gradients. Then, a new model for predicting the gas threshold pressure gradients while taking into consideration the rock permeability and gas continuity comprehensively was established, and the prediction results of the gas threshold pressure gradient predicting models established based on different gas continuity characterization parameters were compared and analyzed. Finally, based on the logging interpretation results of the gas wells in this reservoir, the gas threshold pressure gradients of different types of reservoirs were predicted using the gas threshold pressure gradient predicting model established on the basis of relative movable gas saturation. And the following research results were obtained. First, the relative movable gas saturation takes into consideration the influence of irreducible water saturation and residual gas saturation on gas continuity, and compared with water saturation, it can describe the gas continuity in porous media more accurately. Second, gas threshold pressure gradients increase with the decrease of rock permeability or relative movable gas saturation, and when permeability or relative movable gas saturation is lower, they rise sharply with the decrease of permeability or relative movable gas saturation. Third, the gas threshold pressure gradients of type I reservoirs in the main gas reservoirs of the Puguang Gas Field are lower with a magnitude order of 0.01 MPa/m. The gas threshold pressure gradients of type Ⅱ reservoirs are higher than those of type Ⅰ reservoirs, while the gas threshold gradients of type Ⅲ reservoirs

rise sharply. In conclusion, the gas threshold pressure gradient predicting model established based on relative movable gas saturation can describe more accurately the variation laws of gas threshold pressure gradients with rock permeability and gas continuity. These research results lay a foundation for the correct understanding of the seepage laws of the gas-water two-phase flow in water drive gas reservoirs.

Number of references: 24

Main heading: Gas permeability

Controlled terms: Forecasting - Gas industry - Gases - Hydrocarbon seepage - Petroleum reservoirs - Porous materials - Pressure gradient - Two phase flow

Uncontrolled terms: Carbonate reservoir - Gas saturations - Prediction model - Puguang gas field - Sichuan Basin - Threshold pressure gradient

Classification code: 512.1.1 Oil Fields - 522 Gas Fuels - 631.1 Fluid Flow, General - 931.2 Physical Properties of Gases, Liquids and Solids - 944.4 Pressure Measurements - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.12.008

Database: Compendex

89.

Accession number: 20200208027876

Title: **Influence of 800 kV UHVDC in earth on buried steel line pipes**

Title of translation: **800 kV特高压直流入地电流对埋地钢管道的影响**

Authors: Zhang, Liang ; He, Mo ; Zhang, Lingfan

Author affiliation: Institute of Safety, Environmental Protection and Technical Supervision, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Source title: Natural Gas Industry

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In this paper, one pipeline in the southwestern China was taken as the research object to study the influence of a UHVDC transmission system in the operation mode of monopole ground return on the buried steel line pipes nearby. A variety of cathodic protection testing technologies, including cathodic protection effectiveness testing, pipe-to-soil potential monitoring, in-pipe current monitoring and pipe corrosion monitoring, were applied along the whole pipeline to continuously test the pipe corrosion and cathodic protection parameters in the discharge process of grounding electrode. Then, the influence degree of the UHVDC in earth on the line pipes and the effectiveness of the corrosion control measures were investigated. And the following research results were obtained. First, in the process of discharge, corrosion protection measures (such as potentiostat and drainage zinc strip) play an active role in mitigating pipe corrosion, but corrosion still happens in some pipeline sections. Second, the discharge of grounding electrode of the line pipes in this area interferes the whole pipeline with the maximum current in the regional pipe 4.84 A, the maximum negative shift of pipe-to-soil potential -4 853 mV, the maximum positive shift +568 mV and the maximum corrosion rate of the pipe wall 0.049 mm/a, which are beyond the control target of the pipeline design. Third, the discharging of UHVDC grounding electrode has a greater impact on line pipes. In conclusion, the research results can provide data support for the compilation of testing and evaluation criteria on the influence degree of UHVDC in earth on buried steel line pipes.

Number of references: 15

Main heading: Pipeline corrosion

Controlled terms: Cathodic protection - Corrosion - Corrosion rate - Drainage - Electric discharges - Electric grounding - Grounding electrodes - Monitoring - Pipelines - Soil testing - Soils - Steel corrosion - Steel research - Underground corrosion - Voltage regulators

Uncontrolled terms: Current monitoring - In-pipe - Pipe-to-soil potential - Pipeline sections - Protection testing - Steel pipeline - Testing and evaluation - UHVDC transmission

Classification code: 483.1 Soils and Soil Mechanics - 539.1 Metals Corrosion - 539.2 Corrosion Protection - 545.3 Steel - 619.1 Pipe, Piping and

Pipelines - 701.1 Electricity: Basic Concepts and Phenomena - 732.1 Control Equipment

Numerical data indexing: Voltage -4.85e+00V, Voltage 8.00e+05V, Electric_Current 4.84e+00A

DOI: 10.3787/j.issn.1000-0976.2019.12.017

Database: Compendex

90.

Accession number: 20194807752216

Title: **A new wellbore fluid load diagnosing model based on the energy conservation law**

Title of translation: **基于能量守恒定律的气井井筒携液工况诊断模型**

Authors: Geng, Xinzhong

Author affiliation: Natural Gas Production & Sale Plant, Sinopec Zhongyuan Oilfield Company, Puyang; Henan; 487162, China

Corresponding author: Geng, Xinzhong (gengxinzhong@163.com)

Source title: Natural Gas Industry

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Liquid load has huge adverse effects on the borehole stability of a gas well. However, the existing liquid load detection techniques are somewhat limited in practical application. For the purpose of clarifying the liquid-carrying mechanism of two-phase flow in the wellbore with a higher liquid production rate, it is necessary to accurately diagnose the presence of liquid loading in the wellbore and reasonably formulate the production measures of the gas well. On the basis of previous studies, this paper established a new model for diagnosing the liquid-

carrying conditions of gas-liquid two-phase vertical pipe flow according to the law of energy conservation. Then, by comparing with field practice statistics and indoor experimental data, the accuracy of the new model was verified. Finally, the new model was applied to analyze the liquid-carrying condition of one certain liquid-producing gas well. And the following research results were obtained. First, when the liquid production rate is lower, the critical liquid-carrying gas rate calculated by the new model is much lower than the calculation result of the Turner model. Second, with the increase of the liquid production rate, the critical liquid-carrying gas rate calculated by the new model increases gradually. And the higher the pressure is, the more obvious the increase of the critical liquid-carrying gas rate is. Third, from the perspective of flow pattern, the gas-liquid two-phase vertical pipe flow can be divided into 5 kinds, including bubble flow, slug flow, transition flow, wave flow and annular mist flow. When the two-phase flow is transition flow, wave flow or annular mist flow, there is no liquid loading in the wellbore. In conclusion, the calculation result of the new model is basically accordant with field practice statistics and indoor experimental data, and its diagnostic conclusion conforms to the actual situations. Obviously, this model is of universality and provides a theoretical support for the diagnosis of liquid-carrying condition and the prevention of fluid loading in liquid-producing gas wells.

Number of references: 19

Main heading: Two phase flow

Controlled terms: Boreholes - Energy conservation - Flow patterns - Gases - Liquids - Loading - Natural gas well production - Natural gas wells - Oil field equipment - Pipe flow - Transition flow

Uncontrolled terms: Calculation results - Diagnostic conclusion - Energy conservation law - Gas rates - Gas well - Law of energy conservation - Liquid loading - Wellbore

Classification code: 511.2 Oil Field Equipment - 512.2.1 Natural Gas Fields - 525.2 Energy Conservation - 631.1 Fluid Flow, General - 691.2 Materials Handling Methods

DOI: 10.3787/j.issn.1000-0976.2019.09.008

Database: Compendex

91.

Accession number: 20193907482147

Title: **An integrated production-supply-storage-marketing system for natural gas development in the Sichuan Basin: Innovation**

and achievements

Title of translation: 四川盆地天然气产业一体化发展创新与成效

Authors: Ma, Xinhua ; Hu, Yong ; Wang, Fuping

Author affiliation: PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Natural Gas Economic Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: July 25, 2019

Publication year: 2019

Pages: 1-8

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Natural gas industrial integration development has been gradually developed by the CNPC and PetroChina over the past six decades in the Sichuan Basin. As a unique economic development strategy and management mode adapting to the development characteristics and environment of regional natural gas industry, it includes industrial chain integration and cooperative innovation development, integrative technological innovation support and integrative management innovation guarantee, and so on. From many successful field practices, achievements have been obtained as follows. (1) Collaborative integration helps promote the construction of reserves and production increase projects, helping to build the first domestic giant 10-billion-m-gas field and create the benefit growth pole of unconventional resources such as shale gas. (2) Integration leads steady development and safe supply of natural gas market, helping to establish the most mature natural gas market and the most perfect natural gas regional transmission and distribution pipeline system in China. (3) Integration enhances the vitality and motivation of science and technology innovation, helping to form a series of natural gas exploration and development technologies with unique characteristics of this basin and construct a perfect R&D system of scientific and technological

innovation in natural gas industry. (4) Integration stimulates the regional economic society and harmonious and stable development, helping to promote the optimization and development of energy structure in Sichuan-Chongqing region, and improve the ecological environment and construction of ecological civilization in Sichuan-Chongqing region. In conclusion, under the present situation of market-oriented reform of China's natural gas industry, this specific integration development mode, with needs for inheritance and development in such special areas with highly coincident resources and markets like the Sichuan Basin, can help promote not only the coordinated and stable development of regional natural gas industry chain, but the construction of natural gas production, supply, storage and marketing system in China.

Number of references: 14

Main heading: Natural gas

Controlled terms: Commerce - Ecology - Gas industry - Gases - Integration - Marketing - Natural gas deposits - Natural gas well production - Proven reserves - Regional planning - Resource valuation

Uncontrolled terms: Achievement - CNPC - Collaborative innovation - Industry chain - Sichuan Basin

Classification code: 403.2 Regional Planning and Development - 454.3 Ecology and Ecosystems - 512 Petroleum and Related Deposits - 522 Gas Fuels - 911.4 Marketing - 921.2 Calculus

DOI: 10.3787/j.issn.1000-0976.2019.07.001

Database: Compendex

92.

Accession number: 20200208027813

Title: **Mechanism of electrosorption recycled waste water-based drilling fluid**

Title of translation: **电吸附再生废弃水基钻井液作用机理**

Authors: Xie, Shuixiang ; Ren, Wen ; Li, Xingchun ; Tang, Chao ; Tong, Kun ; Sun, Jingwen ; Zhang, Mingdong ; Liu, Xiaohui

Author affiliation: State Key Laboratory of Petroleum Pollution Control, Beijing; 102206, China

CNPC Research Institute of Safety and Environmental Technology, Beijing; 102206, China

Chongqing Water Conservancy & Electric Power Vocational

and Technical College, Chongqing; 402160, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: December 25, 2019

Publication year: 2019

Pages: 139-145

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 16

Main heading: Waste treatment

Controlled terms: Adsorption - Catalyst selectivity - Drilling fluids - Electric fields - Infill drilling - Mechanisms - Particle size - Particle size analysis - Scanning electron microscopy - Wastewater reclamation - Wastewater treatment - Water conservation

Uncontrolled terms: Electrolysis reaction - Electrosorption - Regeneration - Solid particles - Viscosity reduction - Water based drilling fluids

Classification code: 444 Water Resources - 452.4 Industrial Wastes Treatment and Disposal - 511.1 Oil Field Production Operations - 601.3 Mechanisms - 701.1 Electricity: Basic Concepts and Phenomena - 802.3 Chemical Operations - 803 Chemical Agents and Basic Industrial Chemicals - 804 Chemical Products Generally - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.12.018

Database: Compendex

93.

Accession number: 20200408064739

Title: **Application of unmanned automatic offtake in gas transmission stations of the West-to-East Gas Pipeline Project**

Title of translation: **输气站场无人化自动分输技术在西气东输工程的实现**

Authors: Liang, Yi ; Peng, Taichong ; Li, Mingyao

Author affiliation: West-East Gas Pipeline Company, PetroChina Pipeline Co., Ltd., Shanghai; 200120, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: November 25, 2019

Publication year: 2019

Pages: 112-116

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 16

Main heading: Gas industry

Controlled terms: Computer circuits - Gas pipelines - Gases - Natural gas - Natural gas pipelines - SCADA systems - Transmissions

Uncontrolled terms: Adaptive - Automatic offtake - Intelligent offtake - SCADA - Unmanned

Classification code: 522 Gas Fuels - 602.2 Mechanical Transmissions - 721.3 Computer Circuits - 731.1 Control Systems

Numerical data indexing: Percentage 1.00e+01%, Percentage 5.00e+00%

DOI: 10.3787/j.issn.1000-0976.2019.11.015

Database: Compendex

94.

Accession number: 20194207561161

Title: **Treatment techniques and execution standards for achieving emissions of shale gas hydraulic fracturing flowback fluids**

Title of translation: **页岩气压裂返排液达标排放执行标准及处理技术**

Authors: Xiong, Chunping ; Xiang, Qigui ; Luo, Xiaolan ; Deng, Hao

Author affiliation: Research Institute of Safety, Environmental Protection and

Technical Supervision, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Sichuan Key Laboratory for Shale Gas Evaluation and Exploitation, Chengdu; Sichuan; 610041, China

CNPC Research Institute of Safety & Environment Technology, Beijing; 102206, China

State Key Laboratory for Pollutant Control and Treatment in Petroleum and Petrochemical Industry, Beijing; 102206, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Publication year: 2019

Pages: 137-145

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 41

Main heading: Industrial water treatment

Controlled terms: Chemical oxygen demand - Chlorine compounds - Desalination - Dissolved oxygen - Fracturing fluids - Gas emissions - Hydraulic fracturing - Leachate treatment - Sewage treatment plants - Shale gas - Wastewater treatment

Uncontrolled terms: Biochemical treatments - Chlorides - Emission standard - Fracturing flowback - Inorganic salts - Pre-Treatment - Treatment technologies

Classification code: 445.1 Water Treatment Techniques - 445.1.2 Water Treatment Techniques for Industrial Use - 452.2 Sewage Treatment - 452.4 Industrial Wastes Treatment and Disposal - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels

DOI: 10.3787/j.issn.1000-0976.2019.08.017

Database: Compendex

95.

Accession 20192206992458

number:

Title: **Research progress in liquid loading prediction of gas wells**

Title of translation: **气井积液预测研究进展**

Authors: Zhang, Liehui ; Luo, Chengcheng ; Liu, Yonghui ; Zhao, Yulong ; Xie, Chunyu ; Zhang, Qi ; Ai, Xianting

Author affiliation: State Key Laboratory for Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

HSE and Technical Supervision Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Northeast Sichuan Division, PetroChina Southwest Oil & Gasfield Company, Dazhou; Sichuan; 635000, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Issue date: January 25, 2019

Publication year: 2019

Pages: 57-63

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to maintain the stable production of low-yield gas wells, it is crucial to accurately predict the onset of liquid loading and take the technical measures of drainage gas recovery in time. In this paper, domestic and foreign prediction and numerical simulation methods used for liquid loading in gas wells were extensively investigated and summarized. Then, the methods which are currently used to interpret the liquid loading in gas wells were analyzed comprehensively, including liquid-droplet reversal model, liquid-film reversal model and gas-well stability analysis method. Finally, the research progress in the transient numerical simulation of gas wells with liquid loading was illustrated. And the following research results were obtained. First, the calculation results of different liquid-loading prediction models and the critical liquid-carrying gas rates of gas wells in different gas reservoirs are greatly different. The mechanism of liquid loading in gas wells is not only caused by single liquid reversal phenomenon, but also the joint effect of formation and

wellbore. Second, in interpreting the dynamic liquid level of gas well, the liquid reversal theory is contrary to the basic rule of gas-liquid two-phase pipe flow. The dynamic liquid level of gas well is related to the transient disturbance of gas well. Based on above studies, the development direction of the studies on the mechanism of liquid loading in gas wells was pointed out as follows. Establish a reasonable wellbore pressure fluctuation model on the basis of the numerical reservoir simulation, and take it as the inner boundary condition. Carry out experimental and theoretical studies on formation-wellbore coupling. Reveal the control mechanisms of liquid loading in different types of reservoirs, and establish liquid-loading prediction model correspondingly so as to provide theoretical basis and technical support for the design of drainage gas recovery of gas wells.

Number of references: 48

Main heading: Loading

Controlled terms: Boreholes - Computer simulation - Drops - Forecasting - Gas industry - Gases - Liquid films - Natural gas well production - Natural gas wells - Numerical methods - Numerical models - Oil field equipment - Petroleum reservoirs - Pipe flow

Uncontrolled terms: Different types of reservoirs - Gas well - Laboratory experiments - Liquid droplets - Numerical reservoir simulations - Numerical simulation method - Transient numerical simulation - Wellbore

Classification code: 511.2 Oil Field Equipment - 512.1.1 Oil Fields - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 631.1 Fluid Flow, General - 691.2 Materials Handling Methods - 723.5 Computer Applications - 921 Mathematics - 921.6 Numerical Methods

DOI: 10.3787/j.issn.1000-0976.2019.01.006

Database: Compendex

96.

Accession number: 20192607106202

Title: **Lithofacies and reservoir characteristics of Permian volcanic rocks in the Sichuan Basin**

Title of translation: **四川盆地二叠系火山岩岩相与储层特征**

Authors: Wen, Long ; Li, Ya ; Yi, Haiyong ; Liu, Xin ; Zhang, Benjian ; Qiu, Yuchao ; Zhou, Gang ; Zhang, Xihua

Author affiliation: Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041,

China

PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Northwest Sichuan Division, PetroChina Southwest Oil & Gasfield Company, Jiangyou; Sichuan; 621741, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 2

Issue date: February 25, 2019

Publication year: 2019

Pages: 17-27

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to provide basis for further exploration and deployment of volcanic gas reservoirs in the Sichuan Basin, we classified Permian volcanic rocks in this basin using drilling, mud logging, assay, logging and seismic data comprehensively. Then, the lithological characteristics, lithofacies characteristics, lithofacies distribution and reservoir characteristics of different types of volcanic rocks were studied. Besides, the main factors controlling the development of volcanic reservoirs were determined. And the following research results were obtained. First, volcanic rocks in the Sichuan Basin can be comprehensively classified into 4 categories (i.e., volcanic lava, vocaniclastic lava, volcaniclastic rocks and sedimentary volcaniclastic rocks), and basalt, breccia lava, tuffaceous breccia lava, tuff, sedimentary tuff are mainly developed. Second, 3 types of volcanic lithofacies are extensively developed in the Sichuan Basin, including overflow facies, effusive facies and volcanic sedimentary facies. Overflow facies is mainly dominated by basalt, effusive facies is mainly composed of volcaniclastic lava, and volcanic sedimentary facies is mainly composed of tuff and sedimentary tuff. Third, volcanic reservoirs are lithologically composed of breccia lava and basalt. Breccia lava reservoirs are pore-type reservoirs of moderate porosity and low permeability with devitrified micropores and dissolution pores as main reservoir space. In basalt, fractures and dissolution pores are mainly developed, and they are porous-fractured reservoirs with lower matrix porosity. Fourth, the factors controlling volcanic reservoirs mainly include lithology, lithofacies, later fluid alteration and tectonism. Volcaniclastic

lava is devitrified in the process of rapid condensation, and a great number of dispersion-shape micropores are formed to provide favorable conditions for further dissolution and pore enhancement in the later stage. Post-diagenesis effect (e.g. dissolution) and fracture development make the reservoir properties better. In conclusion, the areal distribution of volcanic reservoirs in the Sichuan Basin is mainly controlled by the lithofacies. Porous-fractured basalt reservoirs are mainly developed in the Ya'an-Leshan-Pingshan area in the southwestern Sichuan Basin, and pore-type vocaniclastic lava reservoirs are mainly developed in the Chengdu-Jianyang-Santai area.

Number of references: 27

Main heading: Petroleum reservoir engineering

Controlled terms: Basalt - Classification (of information) - Dissolution - Fracture - Lithology - Low permeability reservoirs - Microporosity - Mud logging - Petroleum prospecting - Sedimentary rocks - Sedimentology - Seismology - Volcanic rocks - Volcanoes

Uncontrolled terms: Later fluid alteration - Lithofacies - Permian - Reservoir characteristic - Sichuan Basin - Tectonism

Classification code: 481.1 Geology - 482.2 Minerals - 484 Seismology - 484.1 Earthquake Measurements and Analysis - 512.1 Petroleum Deposits - 512.1.2 Petroleum Deposits : Development Operations - 716.1 Information Theory and Signal Processing - 802.3 Chemical Operations - 931.2 Physical Properties of Gases, Liquids and Solids - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.02.003

Database: Compendex

97.

Accession number: 20192607106208

Title: **Horizontal well fracturing mode of "increasing net pressure, promoting network fracture and keeping conductivity" for the stimulation of deep shale gas reservoirs: A case study of the Dingshan area in SE Sichuan Basin**

Title of translation: **深层页岩气水平井"增净压, 促缝网, 保充填"压裂改造模式-以四川盆地东南部丁山地区为例**

Authors: Duan, Hua ; Li, Heting ; Dai, Junqing ; Wang, Yongjun ; Chen, Si'an

Author affiliation: Sinopec Exploration Company, Chengdu; Sichuan; 610041, China

Sinopec Southwest Petroleum Company, Chengdu; Sichuan; 610041, China

Source title: Natural Gas Industry

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Issue date: February 25, 2019

Publication year: 2019

Pages: 66-70

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The deep shale gas reservoirs of Upper Ordovician Wufeng-Lower Silurian Longmaxi Formation in the Dingshan area of the southeastern Sichuan Basin have a great burial depth and complicated geologic features, so the fracturing technologies that are used for medium-shallow shale gas reservoirs are not suitable for their stimulation. In this paper, "double sweet spot" zones of shale gas were selected by combining engineering and geological research. The horizontal well fracturing technology suitable for deep shale gas reservoir was developed. And the fracturing mode suitable for medium-shallow shale gas reservoirs was improved. In addition, the improved fracturing mode and technology were applied in 3 deep shale gas wells in the Dingshan area. And the following research results were obtained. First, the deep shale gas reservoirs in the northwest of the Dingshan area have the characteristics of "double sweet spot" of geology and fracturing, and the development of natural fractures and bedding fractures provides a favorable condition for the formation of complex fracture networks after fracturing. Second, a combined fracturing mode of "pre acid + gel + slickwater + gel" was developed for the "double sweet spot" zones. In this mode, high-viscosity slickwater is adopted to increase the sand-carrying capacity of liquid and enhance the fracture-creating effect, the fracturing technology of "controlling the near and extending the far" can increase the effective stimulated reservoir volume far from the well, and the ultra-high pressure facility can increase the fracturing displacement and the net pressure in fractures. Third, after reservoir stimulation, 3 deep shale gas wells present remarkable stimulation results, and their shale gas production rate during the testing is in the range of 10.50×10-20.56×10 m/d. In conclusion, the improved

fracturing mode and technology can provide a technical method for the stimulation of deep shale gas reservoirs in the Dingshan area, as well as a support for the breakthrough of exploration and development of deep shale gas r eservoirs.

Number of references: 15

Main heading: Fracture

Controlled terms: Gas industry - Gases - Geology - High pressure effects - Horizontal wells - Hydraulic fracturing - Natural gas well production - Natural gas wells - Petroleum prospecting - Petroleum reservoirs - Shale gas - Well stimulation - Well testing

Uncontrolled terms: Controlling the near and extending the far - Dingshan area - Sichuan Basin - Silurian - Ultrahigh pressure

Classification code: 481.1 Geology - 512 Petroleum and Related Deposits - 522 Gas Fuels - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.02.009

Database: Compendex

98.

Accession number: 20192206992466

Title: **Development and application of new technologies and equipments for in-line pipeline inspection**

Title of translation: **油气管道内检测新技术与装备的开发及应用**

Authors: Hu, Tiehua ; Guo, Jingbo

Author affiliation: Department of Electrical Engineering, Tsinghua University, Beijing; 100084, China

Sichuan Energy Internet Research Institute, Tsinghua University, Chengdu; Sichuan; 265500, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: January 25, 2019

Publication year: 2019

Pages: 118-124

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In-line inspection is one of the most effective technical measures to ensure the safety of oil and gas pipelines. However, the extensive application of oil and gas pipelines of high-carbon steel, large diameter, high pressure and high flow rate in recent years brings about new challenges to in-line inspection. In this paper, we investigated the engineering application of new technologies and equipments, including the in-line inspection technology based on electrocmagnetic detector array, the extremely low frequency transient weak signal detection technology and new in-line inspection equipments. Then, the new technology and equipment of electrocmagnetic detector array were developed by applying the active emission and receiving of electromagnetic signal to inspect the metallic defects. Finally, noisy signals were inspected on the basis of Duffing chaotic oscillator, and thus the inspection of extremely low frequency signals in the noise was realized. In addition, the new method and equipment of extremely low frequency transient weak signal detection were developed and verified in actual inspection engineering. And the following research results were obtained. First, the in-line inspection technology based on electrocmagnetic detector array uses the synergetic effect between DC exciting magnetic field and high-frequency exciting magnetic field, so a perturbation response can be realized even by small signal excitation. Second, with the introduction of a novel compressive sampling of acquisition information composition, the speed bottleneck of in-line detector is broken through, and a new world record of the inspection speed of the electrocmagnetic detector array is set up, i.e., 8 m/s. Third, under the condition of high-speed movement, the received signals of in-line detector are weak and temporary while tracking and positioning outside the pipeline. And by virtue of the extremely low frequency transient weak signal detection method based on chaos, this technical bottleneck is broken through, and the signalto- noise ratio (SNR) of transient weak signal in the process of real-time inspection is decreased below -10 dB. In conclusion, the superior performance of these new equipments has already been verified in the inspection engineering of in-service oil and gas pipelines. These research results will provide technical and equipment support for the safe operation of domestic main oil and gas pipelines.

Number of references: 13

Main heading: Signal detection

Controlled terms: Chaos theory - Circuit oscillations - Defects - Gases - Inspection - Inspection equipment - Leakage (fluid) - Magnetic fields - Magnetic leakage - Pipelines - Signal to noise ratio

Uncontrolled terms: Development and applications - Engineering applications - Extremely low frequencies - High frequency HF - In-line inspections - Oil-and-Gas pipelines - Signaltonoise ratio (SNR) - Technology and equipments

Classification code: 619.1 Pipe, Piping and Pipelines - 701.2 Magnetism: Basic Concepts and Phenomena - 703.1 Electric Networks - 716.1 Information Theory and Signal Processing - 913.3.1 Inspection - 921 Mathematics - 922 Statistical Methods - 951 Materials Science - 961 Systems Science

Numerical data indexing: Decibel -1.00e+01dB, Velocity 8.00e+00m/s

DOI: 10.3787/j.issn.1000-0976.2019.01.014

Database: Compendex

99.

Accession number: 20192206992461

Title: **Production performance of and development measures for typical platform horizontal wells in the Weiyuan Shale Gas Field, Sichuan Basin**

Title of translation: **四川盆地威远区块典型平台页岩气水平井动态特征及开发建议**

Authors: Wei, Yunsheng ; Qi, Yadong ; Jia, Chengye ; Jin, Yiqiu ; H., Yuan

Author affiliation: PetroChina Research Institute of Petroleum Exploration & Development, Beijing; 100083, China

Source title: Natural Gas Industry

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Pages: 81-86

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The Weiyuan Shale Gas Field (hereinafter, "Weiyuan Block" for short) is located in the Changning-Weiyuan National Shale Gas Demonstration Region, Sichuan Basin. In the Weiyuan Block, gas wells even on the same platform are quite different in production performance. And so far, the main factors controlling the gas production rate of shale gas wells in this block and the effectiveness of their development technologies and measures have not been understood clearly. In this paper, 6 horizontal wells on PT2 platform in the Weiyuan Block were taken as the research objects. Aiming at the differences of production performance between these gas wells, this paper analyzes the high-quality shale drilling length, dip direction of horizontal section, length of fracturing interval, number of fracturing stages, sand volume and bottom-hole liquid loading to figure out the main factors affecting the gas production rate of shale-gas horizontal wells. Then, it proposes the targeted development measures and suggestions. And the following research results were obtained. First, high-quality shale drilling length is the material and geological guarantee for the high yield of gas wells, and length of horizontal fracturing interval, number of fracturing stages/clusters and sand volume are the main engineering factors. Second, in the early production stage of shale gas wells, the produced gas contains liquid with higher water-gas ratios. When gas production rate is lower than the critical liquid-carrying flow rate, the effect of bottom-hole liquid loading on gas production rate and wellhead pressure cannot be ignored. Third, it is recommended that small tubing (ID≤62 mm) be applied to low-yield wells. When the upward inclined well has low production, skid-mounted drainage gas recovery tools and measures shall be adopted as early as possible to release gas well productivity. And when the downward inclined well has low production, the production method of decreasing tubing pressure shall be adopted to prevent the early bottom-hole liquid loading.

Number of references: 22

Main heading: Oil field equipment

Controlled terms: Flow rate - Fracture - Gas engineering - Gas industry - Gases - Horizontal wells - Infill drilling - Liquids - Loading - Natural gas well production - Natural gas wells - Oil field development - Shale gas - Tubing - Wellheads

Uncontrolled terms: Changning-Weiyuan National Shale Gas Demonstration Region - Development measure - Production controlling - Production performance - Sichuan Basin - Weiyuan Shale Gas Field

Classification 511.1 Oil Field Production Operations - 511.2 Oil Field

code: Equipment - 512 Petroleum and Related Deposits - 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 631 Fluid Flow - 691.2 Materials Handling Methods - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.01.009

Database: Compendex

100.

Accession number: 20192607106203

Title: **Features and recognition for seismic facies of Permian volcanic reservoirs in the Sichuan Basin**

Title of translation: **四川盆地二叠系火山岩地震相特征及识别**

Authors: Chen, Xiao ; He, Qinglin ; Ran, Qi ; Chen, Kang ; Han, Song ; Huang, Tianjun ; Lü, Yan

Author affiliation: Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 2

Issue date: February 25, 2019

Publication year: 2019

Pages: 28-36

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Exploration of volcanic gas reservoirs in the Sichuan Basin is faced with a series of difficulties, e.g. fewer wells, difficult identification of lithology and lithofacies, undefined reservoir distribution, and unmatched seismic prediction technology of reservoirs. In order to characterize the favorable lithofacies of volcanic rocks in the Sichuan Basin, to qualitatively and quantitatively predict reservoirs, we carried out seismic imaging quality processing on the target layers of volcanic rocks based on low-frequency amplitude-preserved processing, and interpreted and characterized the distribution range of volcanic

rocks by establishing the seismic reflection model of volcanic rocks. Then, the seismic facies model of volcanic rock was established based on the seismic response characteristics of volcanic rocks in the southwest of the Sichuan Basin to identify the volcanic edifices and characterize the favorable lithofacies of volcanic rocks. Finally, wave impedance inversion of the volcanic reservoirs in Well Block Yongtan 1 and qualitative and quantitative reservoir prediction were conducted based on facies control. And the following research results were obtained. First, the seismic data processing method based on low-frequency amplitude-preserved processing is effective in improving the image quality inside volcanic rocks and their underlying formations. Second, the identification mode of Permian volcanic rocks is continuous strong peak refection or discontinuous moderate peak reflection at the top boundary and weak reflection at the bottom boundary. And 5 types of seismic reflection characteristics and 3 seismic facies of volcanic rocks (effusive facies, overflow facies and volcanic sedimentary facies) are identified. Third, in the Jianyang-Santai area, effusive facies is extensively distributed. Near-crater effusive facies developed in the most favorable reservoirs is distributed in the dotted form along the northeast with an area of 1 500 km, and far-crater effusive facies developed in the secondary favorable reservoirs covers an exploration area of 6 000 km. Fourth, favorable reservoirs in Well Block Yongtan 1 cover an area of 600 km and their thickness is between 10 m and 200 m. They are mainly distributed in Chengdu-Jianyang area with a huge natural gas exploration potential. In conclusion, the matching technologies developed in this paper (e.g. the seismic data processing based on low-frequency amplitude-preserved processing, the lithology and lithofacies identification and interpretation of volcanic rock, and the facies-control wave impedance inversion) are suitable for the prediction of Permian volcanic reservoirs in the Sichuan Basin, and they provide a technical support for oil and gas exploration in this field.

Number of references: 21

Main heading: Volcanic rocks

Controlled terms: Data handling - Forecasting - Geological surveys - Image enhancement - Image quality - Lithology - Natural gas wells - Petroleum prospecting - Petroleum reservoirs - Sedimentary rocks - Seismic prospecting - Seismic response - Seismic waves - Volcanoes

Uncontrolled terms: Effusive facies - Imaging processing - Low-frequency - Permian - Seismic exploration - Seismic facies - Sichuan Basin

Classification code: 481.1 Geology - 481.4 Geophysical Prospecting - 482.2 Minerals - 484 Seismology - 512 Petroleum and Related Deposits - 723.2

Data Processing and Image Processing

Numerical data indexing: Area 1.50e+09m2, Area 6.00e+08m2, Area 6.00e+09m2, Size 1.00e+01m to 2.00e+02m

DOI: 10.3787/j.issn.1000-0976.2019.02.004

Database: Compendex

101.

Accession number: 20193607404625

Title: **Characteristics and main controlling factors of the Middle Permian Maokou dolomite reservoirs in the eastern Sichuan Basin**

Authors: Hu, Dongfeng ; Wang, Liangjun ; Huang, Renchun ; Duan, Jinbao ; Xu, Zuxin ; Pan, Lei

Author affiliation: Sinopec Exploration Company, Chengdu; Sichuan; 610041, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 6

Issue date: June 25, 2019

Publication year: 2019

Pages: 13-21

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Significant discoveries have been made in the gas exploration of layered-like dolomite reservoir of the Middle Permian Maokou Fm in eastern Sichuan Basin. However, no consensus has been reached on the genesis and distribution of dolomitization in this formation, which restricts the exploration and deployment of natural gas in this area. For clarifying the direction of natural gas exploration in the Maokou Fm in this area, based on the petrographic and geochemical characteristics of core and outcrop samples, the dolomite reservoir characteristics, genesis and main controlling factors in the Maokou Fm were studied, and the dolomite development pattern was established. The results show that: (1) the Maokou Fm dolomite is mainly

developed in the middle and lower part of the third member of the Maokou Fm, generally in a layered or stratoid style. The lithology is mainly fine-medium crystal dolomite, siliceous dolomite, and bioclastic dolomite etc. The reservoir physical properties are better, and there are mainly two types of reservoir space developed: pore and hydrothermal dissolution fracture-cave; (2) different features are shown in trace elements and their contents, strontium isotope ratios and inclusion homogenization temperatures of between dolomite and saddle dolomite in the matrix of the Maokou Fm, which indicates that the formation fluids or periods of the above two types of dolomite differ greatly. The early hydrothermal sedimentation formed the matrix dolomite, and the late hydrothermal dissolution reformation formed the saddle-like dolomite filled with fractures and caves; (3) the development and distribution of the dolomite in the Maokou Fm are jointly controlled by the bioclastic beach, hydrothermal sedimentation and basement faults. Among them, the bioclastic beach is the base of developing dolomite reservoir, hydrothermal sedimentation formed early layered matrix dolomite, and basement faults provided migration channels for later Mg-rich hydrothermal fluids and improved reservoir performance. The research results are of great significance to deepening the understanding of the genesis and distribution of the Maokou dolomite reservoir in the eastern Sichuan Basin.

Number of references: 21

Main heading: Petroleum prospecting

Controlled terms: Beaches - Buildings - Dissolution - Exploratory geochemistry - Geological surveys - Lithology - Natural gas - Sedimentation - Trace elements

Uncontrolled terms: Dolomite reservoirs - East area - Hydrothermal dissolution reformation - Main controlling factors - Permian - Sichuan Basin

Classification code: 402 Buildings and Towers - 407.3 Coastal Engineering - 481.1 Geology - 481.2 Geochemistry - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 802.3 Chemical Operations

DOI: 10.3787/j.issn.1000-0976.2019.06.002

Database: Compendex

102.

Accession number: 20194207561228

Title: **A new method for evaluating settlement stability of cement**

slurry: Micro-pressure fluctuation tests for cement slurry filtration-settlement coupling

Title of translation: **一种评价水泥浆沉降稳定性的新方法--微压力波动测试水泥浆滤失-沉降耦合作用**

Authors: Wang, Tao ; Shen, Feng ; Ma, Zhenfeng ; Yang, Xianlun ; Wang, Weikun ; Jia, Hongjun

Author affiliation: Research Institute, Shaanxi Yanchang Petroleum <Group> Co., Ltd., Xi'an; Shaanxi; 710075, China

Shaanxi Key Laboratory of Lacustrine Shale Gas Accumulation and Exploitation <Under Planning>, Xi'an; Shaanxi; 710075, China

SEDIN Engineering Co., Ltd., CNCEC, Taiyuan; Shanxi; 030000, China

PetroChina Tarim Oilfield Company, Korla; Xinjiang; 841000, China

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Volume: 39

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Issue date: August 25, 2019

Publication year: 2019

Pages: 96-103

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The existing cement slurry settlement stability test methods cannot describe the process of settlement. To improve the accuracy and scientific nature of cement slurry settlement stability tests, we designed a micro-pressure fluctuation tester to test the pressure fluctuation at each segment of slurry column under the coupling condition of water loss and settlement. And based on this, we evaluated the upper-lower density difference of the slurry, and analyzed the stability of the cement slurry at different viscosities, temperatures, water losses, solid particles and thixotropy. And the following research results were obtained. First, the settlement process of cement slurry can be divided into high speed period, low speed period, stable period and weightlessness period, and the water loss in the high speed period can reduce the upper-lower density difference of the slurry. Second, the larger the water loss, the lower the viscosity.

For the materials of the same type, the greater the water-solid ratio, the greater the density difference and the poorer the settlement stability. Third, the effect of temperature on the settlement stability is irregular due to the synergetic effect of water loss reducer. The effect of the water loss reducer of high molecular polymer type is stronger than that of film-forming type. Fourth, increasing the thixotropy of cement slurry can improve its settlement stratification. The shorter the formation time of bonding strength, the better the effect. In conclusion, compared with the conventional method for evaluating the settlement stability of cement slurry, this new method can describe the whole process of sedimentation and it takes the effect of water loss on settlement into consideration, so it can reflect the actual downhole situations more accurately.

Number of references: 25

Main heading: Cements

Controlled terms: Reservoirs (water) - Stability - Testing - Viscosity

Uncontrolled terms: Cement slurry - Evaluation method - Fluctuation - Thixotropy - Water loss

Classification code: 412.1 Cement - 441.2 Reservoirs - 631.1 Fluid Flow, General

DOI: 10.3787/j.issn.1000-0976.2019.08.012

Database: Compendex

103.

Accession number: 20200208027968

Title: **Lithofacies types and assemblage features of continental shale strata and their significance for shale gas exploration: A case study of the Middle and Lower Jurassic strata in the Sichuan Basin**

Title of translation: **陆相页岩层系岩相类型, 组合特征及其油气勘探意义--以四川盆地中下侏罗统为例**

Authors: Liu, Zhongbao ; Liu, Guangxiang ; Hu, Zongquan ; Feng, Dongjun ; Zhu, Tong ; Bian, Ruikang ; Jiang, Tao ; Jin, Zhiguang

Author affiliation: State Key Laboratory of Shale Oil & Gas Enrichment Mechanisms and Effective Development, Beijing; 100083, China

Sinopec Exploration & Production Research Institute, Beijing; 100083, China

School of Earth and Space Science, Peking University, Beijing; 100871, China

College of Geosciences, China University of Petroleum, Beijing;

102249, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 12

Issue date: December 25, 2019

Publication year: 2019

Pages: 10-21

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Fine identification and division of lithofacies types of continental shale strata is an important basis for the evaluation of shale gas exploration and development potential. At present, however, there is no consensus on the identification standard and division scheme of shale lithofacies. Taking the continental shale strata of Middle and Lower Jurassic in the Sichuan Basin as an example, this paper established a lithofacies division method by means of core observation, whole-rock mineral X-ray diffraction analysis, thin section analysis, total organic carbon (TOC) measurement and helium porosity measurement after analyzing whole-rock mineral composition and shale characteristics. Then lithofacies types of shale strata were identified and divided, and characteristics of lithofacies assemblages in different scales were investigated. Finally, their significance for shale gas exploration was discussed. And the following research results were obtained. First, 20 shale lithofacies types of 6 categories are totally identified in this continental shale strata using the newly established three-step lithofacies division method (whole-rock mineral composition partition-TOC classification-correction and improvement of mineral structure and sedimentary structure). And among them, medium-high TOC clay shale lithofacies, lamina-thin layer clay shale lithofacies and low-medium TOC silty shale lithofacies are dominant, followed by low-medium TOC shell limy clay shale lithofacies, and TOC bearing and low TOC silty clay shale lithofacies. Second, the average TOC and the porosity of clay shale lithofacies and shell limestone clay shale lithofacies are higher than those of silty and silty clay shale lithofacies. It is indicated that mineral composition and lithofacies types of shale have a certain impact on gas source and reservoir performance. Third, three assemblages are identified in the continental shale strata, including mudstone-

limestone assemblage, mudstone-sandstone assemblage and mudstone-limestone-sandstone assemblage, which reflect the sedimentary characteristics of distal region, proximal region and transition region in the lacustrine environment, respectively; and that the characterization of different lithofacies assemblages is conducive to recognizing the differences between different shale sedimentary environments. Fourth, fine identification and statistic of the number and frequency of limy shell laminae and thin layers in the terrestrial organic rich shale with a high clay mineral content can provide a basis for the fracturability evaluation of gas rich zones and the selection of optimal exploration and development intervals.

Number of references: 22

Main heading: Petroleum prospecting

Controlled terms: Gases - Geological surveys - Lime - Limestone - Mineral exploration - Minerals - Organic carbon - Porosity - Sandstone - Sedimentology - Shale gas - X ray powder diffraction

Uncontrolled terms: Endmembers - Jurassic - Lithofacies - Sedimentary environment - Sichuan Basin

Classification code: 481.1 Geology - 482.2 Minerals - 501.1 Exploration and Prospecting Methods - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 804.1 Organic Compounds - 804.2 Inorganic Compounds - 931.2 Physical Properties of Gases, Liquids and Solids

DOI: 10.3787/j.issn.1000-0976.2019.12.002

Database: Compendex

104.

Accession number: 20194807753810

Title: **Phase behaviors of CO2 in the whole process of injection-fracturing-flowback: A case study of Well SH52 in a tight sandstone gas reservoir of the Shenmu Gas Field, Ordos Basin**

Title of translation: **"注入-压裂-返排"全过程的CO2相态特征--以鄂尔多斯盆地神木气田致密砂岩气藏SH52井为例**

Authors: Tang, Yong ; Hu, Shilai ; Wang, Yong ; Ye, Liang ; Ding, Yong ; Yang, Guangyu ; Li, Hexiang ; Su, Yincheng

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Oil and Gas Technology Institute, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710018, China

National Engineering Laboratory of Low-Permeability Oil & Gas Exploration and Development, Xi'an; Shaanxi; 710018, China

No.2 Oil Production Plant, PetroChina Huabei Oilfield Company, Bazhou; Hebei; 065709, China

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Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Publication year: 2019

Pages: 58-64

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 23

Main heading: Carbon dioxide

Controlled terms: Bottom hole pressure - Computer software - Fracture - Fracturing fluids - Gas industry - Gases - Injection (oil wells) - Liquids - Metamorphic rocks - Numerical models - Petroleum reservoirs - Phase behavior - Sandstone - Tight gas - Viscosity

Uncontrolled terms: Gas fields - Ordos Basin - Technological parameters - Tight sandstone gas - Whole process

Classification code: 482.2 Minerals - 511.1 Oil Field Production Operations - 512 Petroleum and Related Deposits - 512.1.1 Oil Fields - 522 Gas Fuels - 631.1 Fluid Flow, General - 723 Computer Software, Data Handling and Applications - 801.4 Physical Chemistry - 804.2 Inorganic Compounds - 921 Mathematics - 951 Materials Science

Numerical data indexing: Volume 4.00e+02m3

DOI: 10.3787/j.issn.1000-0976.2019.09.007

Database: Compendex

105.

Accession number: 20194807753808

Title: **A method for measuring the heights of blowout liquid columns on an offshore drilling platform based on image recognition**

Title of translation: **海上钻井平台井喷液柱高度的图像识别测量方法**

Authors: Sun, Xiaofeng ; Yao, Di ; Liu, Shujie ; Ren, Meipeng ; Geng, Yanan

Author affiliation: School of Petroleum Engineering, Northeast Petroleum University, Daqing; Heilongjiang; 163318, China

CNOOC Research Institute, Beijing; 100028, China

Corresponding author: Yao, Di (hatsunemikufan@163.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 96-101

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Once a blowout accident happens during oil and gas well drilling operation, the key to the formulation of a well-killing emergency plan is to accurately measure and determine the height of blowout liquid columns when the rescue personnel cannot approach to the wellhead directly to access the wellhead pressure parameters. To this end, this paper developed a method for measuring the height of the blowout liquid columns by virtue of the image processing technology based on the OpenCV computer vision library. The method includes the following three parts. First, use a CCD camera on a rescue boat to shoot the blowout liquid columns for continuous transient imaging. And each time the blowout liquid column is shot, take 3 photos after rotating it by 120° respectively. Second, images are pre-processed using histogram equalization and high-frequency emphasis filtering, and then they are binarized by means of the modified Otsu algorithm to define the outline of the blowout liquid columns. Third, the boundary points and

holes in the binary images are processed by virtue of mathematical morphology operation, and the actual heights of the blowout liquid columns are calculated using the reference object method. The following results were obtained by conducting indoor simulation experiments. First, this method has a high accuracy in the identification of the blowout liquid column with an error about 6%, and it can measure the height of the blowout liquid column more accurately. Second, in the process of the experiments, the average time for processing one image is 0.86 seconds, which can meet the requirements for the real-time identification and measurement of the blowout liquid columns after an accident happens. In conclusion, this method is feasible to measure the heights of blowout liquid columns. When it is used for the programmed processing of the blowout images, the heights of blowout liquid columns can be measured continuously in real time after the blowout in the offshore drilling platform is out of control, and the key parameters related to the blowout can be acquired for the first time, so as to provide a basis for the formulation of a well-killing emergency plan.

Number of references: 18

Main heading: Blowouts

Controlled terms: Binary images - CCD cameras - Drilling platforms - Equalizers - Filtration - Graphic methods - Image recognition - Infill drilling - Liquids - Mathematical morphology - Offshore drilling - Offshore gas wells - Offshore oil well production - Offshore oil wells - Oil well drilling - Wellheads

Uncontrolled terms: Emergency plans - High frequency HF - Histogram equalizations - Liquid columns - Otsu algorithm

Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512 Petroleum and Related Deposits - 713.5 Electronic Circuits Other Than Amplifiers, Oscillators, Modulators, Limiters, Discriminators or Mixers - 714.2 Semiconductor Devices and Integrated Circuits - 723.2 Data Processing and Image Processing - 802.3 Chemical Operations - 914.1 Accidents and Accident Prevention

Numerical data indexing: Percentage 6.00e+00%, Time 8.60e-01s

DOI: 10.3787/j.issn.1000-0976.2019.09.012

Database: Compendex

106.

Accession number: 20194807752214

Title: **Optimization and improvement of multiple LNG high-pressure pumps in parallel operation**

Title of translation: **多台LNG高压泵联动运行的优化与改进**

Authors: Peng, Chao

Author affiliation: PetroChina JingTang Liquefied Natural Gas Co., Ltd., Tangshan; Hebei; 063200, China

Corresponding author: Peng, Chao (pclng@petrochina.com.cn)

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Abbreviated source title: Natur. Gas Ind.

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Language: Chinese

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 30

Main heading: Natural gas transportation

Controlled terms: Flow rate - Pumps - Risk assessment

Uncontrolled terms: Check valves - High pressure pumps - Lng receiving terminals - Operational risks - Optimization measures - Parallel operations - Rate distributions - Tangshan

Classification code: 522 Gas Fuels - 618.2 Pumps - 631 Fluid Flow - 914.1 Accidents and Accident Prevention

DOI: 10.3787/j.issn.1000-0976.2019.09.014

Database: Compendex

107.

Accession number: 20195107877740

Title: **An alteration effect of weathering on pores in shale: A case study of the Niutitang Formation of Lower Cambrian in the northern Hunan province**

Title of translation: **风化作用对页岩孔隙的改造作用-- 以湘北地区下寒武统牛蹄塘组为例**

Authors: Chen, Qian ; Yan, Xiangbin ; Zhang, Jinchuan ; Li, Wanjun ; Guo, Yuanling ; Hong, Taiyuan ; Wang, Ruyue ; Pan, Ting

Author affiliation: Sinopec Exploration & Production Research Institute, Beijing; 100083, China

China University of Geosciences, Beijing; 100083, China

CNPC Economics & Technology Research Institute, Beijing; 100724, China

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Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 10

Issue date: October 25, 2019

Publication year: 2019

Pages: 32-41

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In carrying out shale gas exploration in new areas and new strata, outcrop samples are usually adopted for reservoir evaluation, but uncertainty exists when the pore systems in underground shale are evaluated based on the pore structures of weathered outcrop samples. What's more, how weathering alters shale pores is not figured out yet. In order to clarify the influence of weathering on the pores in black shale, this paper conducted comprehensive characterization and comparative analysis on the outcrop samples of different weathering levels and downhole core samples from the Niutitang Formation of Lower Cambrian in northern Hunan province using Ar-ion milling, field emission scanning electron microscope and gas adsorption techniques. Then, the alteration effect of weathering on the pores in black shale was discussed. And the following research results were obtained. First, the dissolution pores of carbonate mineral/feldspar, inter- crystal pores within pyrite aggregates, organic matter-hosted pores and micro-fractures are more developed in outcropping shale than in underground shale. Second, with the increase of weathering degree, the shale

porosity increases and the specific surface area decreases firstly and then increases. Third, the weathering effect of shale mineral occurs in a certain order. The dissolution of unstable minerals and the oxidation of pyrite happen first, the oxidation of organic matter takes the second place, and the last is the loosening and breaking of matrix minerals. Fourth, the weathering degree of shale can be classified into three levels, i.e., weak, medium and high. The secondary pores in the shale of weak weathering level are mainly derived from the dissolution of carbonate minerals and feldspar and the oxidation of pyrite, and its porosity is up to 12%. The organic matter in the shale of medium weathering level is mostly oxidized, so its porosity is up to 30%. The shale of high weathering level mainly undergoes the loosening of matrix minerals (e.g. clay) and the gradual development of micro-fractures until rocks break. In conclusion, the research results are conducive to the application of outcrop research in shale gas reservoir evaluation and provide support for the shale gas exploration in new areas and new strata.

Number of references: 38

Main heading: Weathering

Controlled terms: Biogeochemistry - Carbonate minerals - Dissolution - Feldspar - Gas adsorption - Gases - Geological surveys - Oil shale - Organic minerals - Oxidation - Petroleum prospecting - Petroleum reservoir evaluation - Petroleum reservoirs - Pore structure - Porosity - Pyrites - Scanning electron microscopy - Shale gas - Specific surface area

Uncontrolled terms: Alteration effects - Breaking - Comparative analysis - Field emission scanning electron microscopes - Mineral dissolution - Organic matter oxidation - Pore alteration - Weathering effects

Classification code: 481.1 Geology - 481.2 Geochemistry - 482.2 Minerals - 512 Petroleum and Related Deposits - 522 Gas Fuels - 802.2 Chemical Reactions - 802.3 Chemical Operations - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Percentage 1.20e+01%, Percentage 3.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.10.004

Database: Compendex

108.

Accession number: 20193907482179

Title: **Formation laws of hydrothermal alteration minerals and the**

genesis of travertine in the Zhacang geothermal field, Guide Basin

Title of translation: 贵德盆地扎仓地热田水热蚀变矿物形成规律及钙华成因

Authors: Feng, Bo ; Song, Dan ; Fu, Lei ; Zhang, Senqi ; Chen, Mingtao ; Jiang, Zhenjiao

Author affiliation: Key Laboratory of Groundwater Resources and Environment, Ministry of Education, Jilin University, Changchun; Jilin; 130012, China

Center for Hydrogeology and Environmental Geology Survey, China Geological Survey, Baoding; Hebei; 071051, China

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Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: July 25, 2019

Publication year: 2019

Pages: 133-142

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Analyzing the distribution characteristics and formation laws of hydrothermal alteration minerals and travertine in hot spring areas can indicate the hydrogeochemical environment in deep strata and reveal the dissolution and precipitation laws of minerals in the evolution process of geothermal field, which is of great significance to the development and utilization of geothermal resources. In this paper, Zhacang geothermal field in the Guide Basin was taken as the research object. In-situ rock samples and water samples in the Guide Basin were adopted to simulate the interaction between recharge water source and geothermal reservoir rock at different temperatures. The simulation was carried out using the high temperature and high pressure reactor under the condition of reservoir pressure. Then, the change laws of the mineral compositions in geothermal reservoirs and the chemical compositions of reaction liquid after water-rock action were analyzed. Finally, the experimental chemical reaction process was simulated using the software TOUGHREACT, the hydrogeochemical evolution laws in the long time scale were predicted, and the formation mechanisms of hydrothermal alteration minerals and travertine in this area were

explored. And the following research results were obtained. First, the water-rock reaction between Gangyi Spring and reservoir rocks in the Guide Basin generates calcium montmorillonite, chlorite and illite. Illite is transformed from calcium montmorillonite, and chlorite is converted from mica mineral or potassium feldspar. In addition, temperature has a significant effect on the conversion rate of minerals. Second, the simulation results at three temperatures (90 ℃, 120 ℃ and 150 ℃) for 100 years show that chlorite is the product in the initial stage of the reaction, and its appearance indicates that the water-rock reaction there is not balanced yet. Third, the effect of temperature on the conversion rate of minerals is obvious. The higher the temperature is, the faster sodium feldspar and montmorillonite deposit and potassium feldspar dissolves. Fourth, a high content of Ca and HCO3 is the necessary hydrochemical conditions for the formation of travertine, and the surface travertine in this area is thermogenic. In conclusion, the dissolution and precipitation laws of hydrothermal alteration minerals reveal the possibility that there is a self-closed system in the Zhacang geothermal field. The research results provide a theoretical support for reconstructing geothermal reservoirs by means of acidic chemical stimulation and developing deep geothermal resources in the future.

Number of references: 28

Main heading: Hydrochemistry

Controlled terms: Calcium - Chemical analysis - Clay alteration - Clay deposits - Clay minerals - Computer simulation - Dissolution - Environmental regulations - Feldspar - Feldspar deposits - Geothermal fields - Hot springs - Limestone - Mica - Mineral exploration - Minerals - Petroleum reservoirs - Potassium

Uncontrolled terms: Closed systems - Guide Basin - Hydrothermal alterations - Laboratory experiments - Travertine

Classification code: 454.2 Environmental Impact and Protection - 481.2 Geochemistry - 481.3.1 Geothermal Phenomena - 482.2 Minerals - 501.1 Exploration and Prospecting Methods - 505.1 Nonmetallic Mines - 512.1.1 Oil Fields - 549.1 Alkali Metals - 549.2 Alkaline Earth Metals - 723.5 Computer Applications - 802.3 Chemical Operations

Numerical data indexing: Age 1.00e+02yr

DOI: 10.3787/j.issn.1000-0976.2019.07.018

Database: Compendex

109.

Accession number: 20193207284635

Title: **Relationship between pressure compartment and hydrocarbon accumulation in the Middle Triassic-Paleozoic in NW Sichuan Basin**

Authors: Chen, Cong ; Zhang, Jian ; Luo, Bing ; Wen, Long ; Lin, Yi ; Zhang, Ya ; Xie, Chen ; Xu, Guosheng

Author affiliation: Research Institute of Exploration and Development, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

Source title: Natural Gas Industry

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Language: Chinese

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: There are multiple belts of normal pressure, high pressure and overpressure in the north section of Longmenshan fault zone in the northwestern (NW) Sichuan Basin. The previous studies on the "pressure compartment" in this area usually took the distribution of overpressure belts in the Sichuan Basin as the basis for defining the range of "pressure compartment", but rarely paid attention to the evolution of pressure compartment and its relationship with hydrocarbon accumulation. In this paper, the compositions of the Middle Triassic- Paleozoic pressure compartment in NW Sichuan Basin were described and its formation process was reproduced by means of well-seismic joint interpretation, Easy%Ro thermodynamic model and balanced profile technology. Based on this, the formation and evolution process of the gas reservoirs of Middle Permian Qixia Fm and Middle Devonian Guanwushan Fm in the pressure compartment was studied. And the following research results were obtained. First, there is an authigenic abnormal pressure

compartment in the Middle Triassic-Paleozoic in NW Sichuan Basin, which is bounded by No.1 buried fault on the west, Jiulongshan structure on the east, the piedmont fault fold belt along the southern margin of Micangshan paleo-uplift on the north and the southern section of Shuangyushi structure belt on the south. This pressure compartment is divided into two sub-compartments (i.e., east and west compartment) with the central line of Jiulongshan structure through Shuangyushi structure belt as the boundary. Second, the farther this pressure compartment is from Longmenshan fault zone, the higher the overpressure degree is. There is a distinct pressure difference between the pressure compartment and the environment. And the pressure coefficient inside the compartment is between 1.4 and 2.0 and that outside the compartment is normal. Third, the Paleozoic pressure compartment was formed in the early stage of Indosinian movement and its current pattern emerged after being adjusted by Yanshan movement and Himalayan movement. Fourth, oil and gas reservoirs of Middle Triassic-Cambrian are the reservoirs which were formed inside the pressure compartment in the Himalayan stage. There are multiple sets of source kitchens inside the pressure compartment, which provide sufficient gas sources, with the roof and the barriers having strong sealing capacity, and the source-reservoir matching relationship is good. And hydrocarbon preferentially accumulates in the high-quality reservoir which is closer to the roof of the pressure compartment. In conclusion, the Paleozoic deep-seated marine reservoirs in this area have extensive oil and gas exploration potential. And among them, Qixia Fm in Shuangyushi-Zhongba area is the most favorable exploration series of strata, and Guanwushan Fm is the potential favorable exploration series of strata.

Number of references: 35

Main heading: Petroleum prospecting

Controlled terms: Hydrocarbons - Oils and fats - Petroleum reservoir engineering - Petroleum reservoirs - Roofs

Uncontrolled terms: Abnormal pressure - Devonians - Hydrocarbon accumulation - Longmenshan fault zone - Permian - Pressure compartment - Sichuan Basin - Structural evolution

Classification code: 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 804.1 Organic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.04.005

Database: Compendex

110.

Accession number: 20193207284526

Title: **Mechanical properties of a coiled tubing blowout preventer ram in the shearing process**

Authors: Liu, Bing ; Li, Tao ; Zhao, Yongjie ; Chen, Jingang ; Zhou, Tingting ; Qi, Yaoguang

Author affiliation: College of Mechanical and Electronic Engineering, Shandong University of Science and Technology, Qingdao; Shandong; 266590, China

College of Electromechanical Engineering, China University of Petroleum <East China>, Qingdao; Shandong; 266580, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Publication year: 2019

Pages: 82-89

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: A shear ram is of great significance to ensuring the safe operation of oil/gas well drilling and production, but the mechanical properties of the ram itself in the shearing process are rarely researched. Based on the basic motion law of the shear ram, combined its structural and operating parameters comprehensively, a model for solving the stress on the cutting edge was established corresponding to three stages (i.e., shear point contact, cutting and penetrating the drill pipe) according to the wedge stress theory. Then, based on the novel shear ram, the numerical simulation and indoor shear experiment were carried out on CT90 coiled tubing to understand the variation laws of ram stress and shear point stress in the shearing process. And the following research results were obtained. First, when the shear point doesn't contact with the CT90 coiled tubing, the stress at the V-shaped angular center of the ram is the largest, and that at the shear point is extremely small. Second, when the shear point just touches the CT90 coiled tubing, the phenomenon of stress concentration occurs in the vicinity of the shear point of the ram cutting edge. Third, when the shear point cuts into the CT90 coiled tubing, the stress on the shear point

and on both sides of the wedge edge is the largest, reaching the strength limit of the ram (1 050 MPa). Fourth, when the shear point enters the annulus after penetrating the CT90 coiled tubing, the ram stress on both sides of the junction between the cutting edge chamfer and the vertical plane is the largest. Fifth, After the CT90 coiled tubing is cut, crack damage occurs in the vicinity of the shear point of the ram cutting edge. In conclusion, the research results can better reflect the stress state of the ram cutting edge and its interaction with the drill pipe in the shearing process, and can provide an important reference for the design, manufacturing and the correct field application of shear rams.

Number of references: 22

Main heading: Coiled tubing

Controlled terms: Blowout preventers - Blowout prevention - Blowouts - Boreholes - Drill pipe - Drills - Industrial research - Infill drilling - Mechanical properties - Oil well drilling - Oil well drilling equipment - Point contacts - Shearing - Shearing machines

Uncontrolled terms: Cutting edges - Field application - Operating parameters - Research results - Safe operation - Shearing process - Strength limits - Stress test

Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512.1.2 Petroleum Deposits : Development Operations - 603.1 Machine Tools, General - 603.2 Machine Tool Accessories - 604.1 Metal Cutting - 619.1 Pipe, Piping and Pipelines - 704.1 Electric Components - 901.3 Engineering Research - 914.1 Accidents and Accident Prevention - 951 Materials Science

Numerical data indexing: Pressure 1.05e+09Pa

DOI: 10.3787/j.issn.1000-0976.2019.04.011

Database: Compendex

111.

Accession number: 20194207561186

Title: **Measures and suggestions on restraining China's excessive growth of natural gas external dependence**

Title of translation: **抑制我国天然气对外依存度过快增长的对策与建议**

Authors: Lu, Jialiang ; Tang, Hongjun ; Sun, Yuping

Author affiliation: PetroChina Research Institute of Petroleum Exploration & Development, Beijing; 100083, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Publication year: 2019

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 18

Main heading: Gases

Controlled terms: Ballast (railroad track) - Commerce - Energy policy - Energy security - Energy utilization - Gas industry - Gas supply - Natural gas - Natural gas deposits - Petroleum deposits - Renewable energy resources

Uncontrolled terms: China - Measures and suggestions - Renewable energies - Supply-demand - Utilization efficiency

Classification code: 512.1 Petroleum Deposits - 512.2 Natural Gas Deposits - 522 Gas Fuels - 525 Energy Management and Conversion - 681.1 Railway Plant and Structures, General

Numerical data indexing: Percentage 4.40e+01%, Percentage 7.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.08.001

Database: Compendex

112.

Accession number: 20195107877560

Title: **Risk analysis of gas explosion on a biogas-to-liquid fuel skid-mounted device and an optimal design**

Title of translation: **沼气制油橇装装置的燃爆风险分析与优化设计**

Authors: Zheng, Xiaoyun ; Chen, Guoming ; Fu, Jianmin ; Zhang, Shuai ;

Yang, Can ; Zhang, Xinqi ; Kong, Depeng

Author affiliation: Center for Offshore Engineering and Safety Technology, China University of Petroleum - East China, Qingdao; Shandong; 266580, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 10

Issue date: October 25, 2019

Publication year: 2019

Pages: 118-126

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 19

Main heading: Explosions

Controlled terms: Biogas - Computational fluid dynamics - Explosives - Gas fuel analysis - Gas industry - Gases - Liquid fuels - Liquids - Optimal systems - Risk analysis - Risk assessment

Uncontrolled terms: Flammable gas cloud - Optimal design - Overpressure - Safety distances - Skid-mounted

Classification code: 522 Gas Fuels - 523 Liquid Fuels - 723.5 Computer Applications - 914.1 Accidents and Accident Prevention - 922 Statistical Methods - 961 Systems Science

Numerical data indexing: Pressure 5.78e+00Pa, Pressure 7.21e+02Pa, Pressure 8.37e+01Pa, Size 3.00e+00m, Size 5.00e-02m, Size 6.00e+00m, Size 9.00e+00m

DOI: 10.3787/j.issn.1000-0976.2019.10.015

Database: Compendex

113.

Accession number: 20200408064793

Title: **Economic benefit evaluation on the natural gas interconnection pipeline project**

Title of **天然气互联互通管道工程的经济效益评价**

translation:

Authors: Gong, Weilong ; Zhang, Jiahong ; Yan, Ruiguang ; Wang, Lixian ; Li, Zhewei ; Zhang, Zhifang ; Guo, Wenhao

Author affiliation: China Petroleum Pipeline Engineering Corporation, Langfang; Hebei; 065000, China

West-East Gas Pipeline Company, PetroChina Pipeline Co., Ltd., Shanghai; 200120, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 132-138

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 17

Main heading: Electric power system interconnection

Controlled terms: Earnings - Economic analysis - Economic and social effects - Function evaluation - Gas supply - Gases - Pipelines - Transfer functions - Water pipelines

Uncontrolled terms: China - Economic benefits - Gas storage - Pipe-line systems - Pipeline engineering - Security functions

Classification code: 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 706.1 Electric Power Systems - 911.2 Industrial Economics - 921 Mathematics - 921.6 Numerical Methods - 971 Social Sciences

Numerical data indexing: Percentage 1.06e+01%, Percentage 1.18e+01%, Percentage 1.67e+00%, Percentage 6.00e+00%, Percentage 6.49e+00%

DOI: 10.3787/j.issn.1000-0976.2019.11.018

Database: Compendex

114.

Accession number: 20193607404723

Title: **A new model for evaluating the displacement efficiency of**

cement slurry

Authors: Yang, Mou ; Tang, Daqian ; Yuan, Zhongtao ; Zhang, Jun ; Xu, Liqun ; Chen, Ying

Author affiliation: State Key Laboratory of Oil & Gas Geology and Exploration, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Oil and Gas Engineering Institute, PetroChina Tarim Oilfield Company, Korla; Xinjiang; 830011, China

Research Institute of Petroleum Engineering Technologies, Sinopec Northwest Oil Field Company, Korla; Xinjiang; 830011, China

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Volume: 39

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Issue date: June 25, 2019

Publication year: 2019

Pages: 115-122

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 12

Main heading: Diffusion in liquids

Controlled terms: Boreholes - Cementing (shafts) - Cements - Computer simulation - Drilling fluids - Efficiency - Infill drilling - Oil well cementing - Shims - Viscosity

Uncontrolled terms: Cement slurry - Diffusion mechanisms - Displacement efficiency - Dynamic displacements - Evolution mechanism - Numerical emulation - Slurry column - Slurry properties

Classification code: 412.1 Cement - 511.1 Oil Field Production Operations - 512.1.2 Petroleum Deposits : Development Operations - 601.2 Machine Components - 631.1 Fluid Flow, General - 723.5 Computer Applications - 913.1 Production Engineering

Numerical data indexing: Percentage 4.60e+00%

DOI: 10.3787/j.issn.1000-0976.2019.06.013

Database: Compendex

115.

Accession number: 20200208027833

Title: **Single-agent thickened acid for acid fracturing of carbonate reservoirs in the eastern area of Sulige Gas Field**

Title of translation: **苏里格气田东区碳酸盐岩储层酸压用单剂稠化酸**

Authors: Bai, Jianwen ; Tao, Xiujuan ; Han, Hongxu ; Zhu, Li'an ; Yang, Chao ; Zhai, Xiaopeng ; Guo, Zhiyang

Author affiliation: College of Petroleum Engineering, Yangtze University, Wuhan; Hubei; 430100, China

Oil and Gas Technology Institute, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710018, China

National Engineering Laboratory of Low-Permeability Oil & Gas Exploration and Development, Xi'an; Shaanxi; 710018, China

Shaanxi University of Science & Technology, Xi'an; Shaanxi; 710021, China

Project Supervision Department, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710018, China

Shaanxi Key Laboratory of Lacustrine Shale Gas Accumulation and Exploitation, Xi'an; Shaanxi; 710075, China

Corresponding author: Tao, Xiujuan (taoxiujuan@sust.edu.cn)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 12

Issue date: December 25, 2019

Publication year: 2019

Pages: 88-94

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 20

Main heading: Fracturing (fossil fuel deposits)

Controlled terms: Additives - Amides - Carbonation - Chlorine compounds - Corrosion - Corrosion inhibitors - Gases - Hydrochloric acid - Iron - Metal ions - Mixing - Petroleum reservoirs - Reservoirs (water) - Viscosity

Uncontrolled terms: Acidizing - Carbonate rock - Construction efficiency - Corrosion inhibition performance - Hydrochloric acid solution - Preparation procedures - Single-agent - Sulige gas field

Classification code: 441.2 Reservoirs - 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 531.1 Metallurgy - 545.1 Iron - 631.1 Fluid Flow, General - 802.2 Chemical Reactions - 802.3 Chemical Operations - 803 Chemical Agents and Basic Industrial Chemicals - 804.1 Organic Compounds - 804.2 Inorganic Compounds

Numerical data indexing: Percentage 2.00e+01%, Percentage 3.00e+00%, Percentage 6.00e+00%, Percentage 8.67e+01%

DOI: 10.3787/j.issn.1000-0976.2019.12.011

Database: Compendex

116.

Accession number: 20193607404572

Title: **An integrated experimental system for gas hydrate drilling and production and a preliminary experiment of the depressurization method**

Authors: Liu, Changling ; Li, Yanlong ; Liu, Lele ; Hu, Gaowei ; Chen, Qiang ; Wu, Nengyou ; Meng, Qingguo

Author affiliation: Key Laboratory of Gas Hydrate, Ministry of Natural Resources, Qingdao Institute of Marine Geology, Qingdao; Shandong; 266071, China

Laboratory for Marine Mineral Resources, Qingdao National Laboratory for Marine Science and Technology, Qingdao; Shandong; 266071, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: June 25, 2019

Publication year: 2019

Pages: 165-172

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 21

Main heading: Gas hydrates

Controlled terms: Data acquisition - Electric resistance - Extraction - Gas industry - Gases - Hydration - Infill drilling - Natural gas - Natural gas fields - Pressure vessels - Reactor cores - Simulation platform - Stochastic systems - Tomography

Uncontrolled terms: CO2 hydrates - Depressurization methods - Electrical resistance tomography - Experimental system - Output law - Real time monitoring

Classification code: 511.1 Oil Field Production Operations - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 619.2 Tanks - 701.1 Electricity: Basic Concepts and Phenomena - 723.2 Data Processing and Image Processing - 746 Imaging Techniques - 802.3 Chemical Operations - 961 Systems Science

Numerical data indexing: Temperature 2.78e+02K, Volume 5.21e-01m3

DOI: 10.3787/j.issn.1000-0976.2019.06.019

Database: Compendex

117.

Accession number: 20194207561123

Title: **Transformation analysis of key liquid phase products during lignite fermentation to produce biological hydrogen**

Title of translation: **褐煤发酵制生物氢过程中关键液相产物的变化规律**

Authors: Xia, Daping ; Huang, Song ; Zhang, Huaiwen

Author affiliation: School of Energy Science and Engineering, Henan Polytechnic University, Jiaozuo; Henan; 454000, China

State Key Laboratory Cultivation Base for Gas Geology and Gas Control, Henan Polytechnic University, Jiaozuo; Henan; 454000, China

Collaborative Innovation Center of Coalbed Methane and Shale Gas for Central Plains Economic Region, Jiaozuo; Henan; 454000, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Issue date: August 25, 2019
Publication year: 2019
Pages: 146-153
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency
Number of references: 21
Main heading: Hydrogen production
Controlled terms: Aromatic hydrocarbons - Coal industry - Fermentation - Ketones - Lignite - Liquids - Volatile fatty acids
Uncontrolled terms: Anaerobic fermentation - Biological hydrogen - GC-MS - Generating mechanism - Liquid Phase - Variation law
Classification code: 522 Gas Fuels - 524 Solid Fuels - 804.1 Organic Compounds
DOI: 10.3787/j.issn.1000-0976.2019.08.018
Database: Compendex

118.

Accession number: 20200408064821

Title: **An optimized calculation method of critical erosion flow rates of UGS injection/production wells**

Title of translation: **地下储气库注采井临界冲蚀流量优化计算方法**

Authors: Wang, Yun ; Zhang, Jianjun
Author affiliation: PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

Source title: Natural Gas Industry
Abbreviated source title: Natur. Gas Ind.
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Publication year: 2019
Pages: 74-80
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency
Number of references: 16
Main heading: Injection (oil wells)
Controlled terms: Chromium compounds - Corrosion rate - Digital storage - Erosion - Flow rate - Gas industry - Moisture - Moisture determination - Oil field equipment - Shear flow - Shear stress - Underground gas storage
Uncontrolled terms: Calculation results - Chart - Different moisture contents - Differential pressures - Erosion coefficients - Laboratory experiments - Production optimization - Wall shear stress
Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 522 Gas Fuels - 631 Fluid Flow - 631.1 Fluid Flow, General - 722.1 Data Storage, Equipment and Techniques - 944.2 Moisture Measurements
Numerical data indexing: Mass_Density 2.50e-01kg/m3, Percentage 1.00e-03%
DOI: 10.3787/j.issn.1000-0976.2019.11.009
Database: Compendex

119.

Accession number: 20193607404684

Title: **Influence of overburden hydration on fracture propagation of shale under three-dimensional stress**

Authors: Wang, Xin ; Li, Deqi ; Jiang, Wei ; Lu, Haibing ; Yi, Xinbin ; Zou, Qingteng ; Wang, Tianyi ; Xiu, Nailing ; Tang, Wei ; Li, Tao

Author affiliation: PetroChina Research Institute of Petroleum Exploration & Development, Langfang; Hebei; 065007, China

Petro-China Zhejiang Oilfield Company, Hangzhou; Zhejiang; 310023, China

Corresponding author: Jiang, Wei (jiangwei69@petrochina.com.cn)

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Publication year: 2019
Pages: 81-86
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency
Number of references: 18
Main heading: Fracture
Controlled terms: Equipment testing - Horizontal wells - Hydration - Hydraulic fracturing - Shale gas
Uncontrolled terms: Development characteristics - Flow back - Fracture propagation - Inclinometer - Low confining pressure - Shale hydration - Similarity criteria - Three-dimensional stress
Classification code: 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 951 Materials Science
DOI: 10.3787/j.issn.1000-0976.2019.06.009
Database: Compendex

120.

Accession number: 20200208027793

Title: **Application of a fuzzy-ball temporary plugging agent to the diverting fracturing of deep carbonate reservoirs**

Title of translation: **绒囊暂堵剂在深层碳酸盐岩储层转向压裂中的应用**

Authors: Jiang, Jianfang ; Zhai, Xiaopeng ; He, Jiayuan ; Geng, Yudi ; Cui, Jia ; Wei, Panfeng

Author affiliation: State Key Laboratory of Petroleum Resources and Prospecting, China University of Petroleum, Beijing; 102249, China

Lost Circulation Prevention and Control Laboratory, National Engineering Laboratory for Oil and Gas Drilling Technology, Yangtze University, Wuhan; Hubei; 430100, China

Sinopec Exploration & Production Research Institute, Beijing; 100038, China

Research Institute of Engineering Technology, Sinopec Northwest Oilfield Company, Urumqi; Xinjiang; 830011, China

Corresponding author: Zhai, Xiaopeng (zhaixiaopeng2006@163.com)

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Issue date: December 25, 2019

Publication year: 2019

Pages: 81-87

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 28

Main heading: Fracture

Controlled terms: Acidization - Bearing capacity - Bearings (machine parts) - Carbonates - Carbonation - Deformation - Elastoplasticity - Petroleum reservoirs - Reservoirs (water) - Sedimentary rocks

Uncontrolled terms: Acidizing - Carbonate rock - Deep layer - Fuzzy balls - Plugging agent - Refracturing

Classification code: 441.2 Reservoirs - 482.2 Minerals - 512.1.1 Oil Fields - 601.2 Machine Components - 802.2 Chemical Reactions - 804.2 Inorganic Compounds - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.12.010

Database: Compendex

121.

Accession number: 20192607106212

Title: **Countermeasures to satisfy the tail gas emission standard of natural gas purification plants**

Title of translation: **天然气净化厂尾气达标排放对策**

Authors: Xiong, Jianjia ; Hu, Yong ; Chang, Honggang ; Li, Jinjin ; Zhou, Daibing

Author affiliation: National Energy R&D Center of High Sulfur Gas Exploitation, Chengdu; Sichuan; 610051, China

PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Research Institute of Natural Gas Technology, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610213, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: February 25, 2019

Publication year: 2019

Pages: 94-101

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In recent years, relevant authorities have successively issued strict control indicators on the tail gas emission of sulfur recovery facilities, so standard tail gas emission from the sulfur recovery facilities in natural gas purification plants is faced with enormous pressure and severe challenges. In this paper, the SO2 emission standards of natural gas purification plants in Canada and America were compared, and the formulation status of domestic SO2 emission standards was analyzed. Then, the existing tail gas processing units in natural gas purification plants were analyzed and compared technologically and economically with the PetroChina Southwest Oil & Gasfield Company as an example. Finally, the transformation process was recommended in consideration of technological advancement and economical rationality comprehensively. And the following research results were obtained. First, the domestic indicator of sulfur recovery ratio of natural gas purification plants is much higher than that in Europe and America. Second, considering the characteristics of all natural gas purification plants in this company, 4 transformation schemes are proposed, including solvent upgrading & operation parameter optimization, transformation of SO2 absorption technology based on organic amine method, transformation of liquid-phase complex iron oxidation/reduction technology, and shut down. And the transformation investment is expected to be CNY 559 million. Third, as for the natural gas purification plants with higher sulfur

recovery rates (>200 t/d), it is recommended to select the technologies of reduction absorption. Fourth, as for the natural gas purification plants with moderate sulfur recovery rates (5-200 t/d), it is recommended to select the SO2 absorption technology based on organic amine method. Fifth, as for the natural gas processing facilities whose potential sulfur rates of feed gas are low (<10 t/d), it is recommended to adopt the l iquid-phase oxidation/reduction technology. In conclusion, tail gas emission from all sulfur recovery facilities of this company can satisfy the national SO2 emission standard and reach the international advanced level after they are transformed by means of the recommended te chnologies.

Number of references: 20

Main heading: Natural gas fields

Controlled terms: Air purification - Gas absorption - Gas emissions - Gas fuel purification - Gas industry - Gas plants - Gas producers - Liquefied natural gas - Natural gas - Natural gasoline plants - Plant shutdowns - Recovery - Sulfur

Uncontrolled terms: Gas fields - National standard - Recovery ratio - SO2 emissions - Sulfur recovery - Tail gas - Transformation scheme

Classification code: 512.2.1 Natural Gas Fields - 513.2 Petroleum Refineries - 522 Gas Fuels - 523 Liquid Fuels - 643 Space Heating, Ventilation and Air Conditioning - 802.3 Chemical Operations - 804 Chemical Products Generally

Numerical data indexing: Mass_Flow_Rate 5.25e-02kg/s to 2.10e+00kg/s

DOI: 10.3787/j.issn.1000-0976.2019.02.013

Database: Compendex

122.

Accession number: 20192607106215

Title: **Sustainable development of natural gas industry**

Title of translation: **天然气产业可持续发展机制**

Authors: Gu, Sui ; Dang, Lurui ; Du, Xiaotian ; Yang, Yawen ; Jing, Daijiao ; Zeng, Cheng ; Xiao, Xin

Author affiliation: Natural Gas Economic Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

PetroChina Southwest Oil & Gasfield Company, Chengdu;

Sichuan; 610051, China

Institute of Safety, Environmental Protection and Technical Supervision, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Shunan Division, PetroChina Southwest Oil & Gasfield Company, Luzhou; Sichuan; 646001, China

Material Supply Division, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610017, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: February 25, 2019

Publication year: 2019

Pages: 117-123

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Sustainable development of natural gas industry will be a strategic choice and endogenous needs to adapt to the requirements of energy revolution, to construct modern energy system, and to achieve the goal of Beautiful China. Previous researches mainly focusing on environment analysis, situation judgment and policy proposal are not applicable to the unique integration and sustainable development process of natural gas industry. In view of this, based upon the coupling of natural gas industry chain system and sustainable development system, this paper established a sustainable development mechanism model of natural gas industry to discuss the robust operating mechanism of this sustainable development system. The following findings were achieved. (1) Stable operation and balanced development of the sustainable development system of natural gas industry will rely on a synergistic combination of gas resource safety guarantee mechanism, gas market allocation system, green development system, and harmonious development system. (2) The gas resource safety guarantee mechanism shall be realized by the intensive management of logistics chain, responsibility chain and management chain. (3) The natural gas market allocation system shall fully consider competition, price and supervision mechanisms. (4) The green development mechanism of natural gas industry chain shall be composed of green development system and policy system,

eco-development system of industrial chain technology and green development cultural system. (5) The natural gas harmonious development system shall dependent on the individual responsibility and joint efforts of enterprises, consumers and government. In conclusion, the synergy of the above four mechanisms shall provide a support for the orderly evolution and transition of t he sustainable developing coupling system of natural gas industry.

Number of references: 17

Main heading: Gas industry

Controlled terms: Accident prevention - Commerce - Energy resources - Environmental protection - Gases - Green manufacturing - Natural gas - Natural gas deposits - Petroleum deposits - Planning - Sustainable development

Uncontrolled terms: Allocation systems - Coupling systems - Development systems - Harmonious development - Safety guarantees

Classification code: 454.2 Environmental Impact and Protection - 512.1 Petroleum Deposits - 512.2 Natural Gas Deposits - 522 Gas Fuels - 525.1 Energy Resources and Renewable Energy Issues - 912.2 Management - 914.1 Accidents and Accident Prevention

DOI: 10.3787/j.issn.1000-0976.2019.02.016

Database: Compendex

123.

Accession number: 20194207561248

Title: **Distribution laws and characteristics of mud films at casing-cement interfaces in horizontal wells**

Title of translation: **水平井固井一界面泥膜分布规律及其特性**

Authors: Gu, Jun ; Li, Shichao ; Tian, Yafang ; Li, Gang ; Zhao, Xinxin ; Li, Linwei ; Tang, Yu

Author affiliation: Faculty of Earth Resources, China University of Geosciences, Wuhan; Hubei; 430074, China

Cementing Company, Sinopec Zhongyuan Petroleum Engineering Co., Ltd., Puyang; Henan; 457001, China

No.1 Gas Production Plant, PetroChina Qinghai Oilfield Company, Golmud; Qinghai; 816099, China

Corresponding author: Li, Shichao (252968818@qq.com)

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Publication year: 2019

Pages: 88-95

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The mud film thickness on the outer surface of casing and its distribution laws are important factors affecting the cementation quality at casing-cement interfaces. So far, however, the distribution laws of mud film thickness on the outer surface of casing at different inclinations and its effect on the interfacial cementing strength have never been reported in literatures. In this paper, the mud film thickness at different parts on the outer surface of simulated casing (steel pipe) was measured at the inclination of 0°, 30°, 60° and 86°, respectively, using the independently designed experimental device. Then, the distribution law of mud film thickness on the outer surface of casing and its effect on the interfacial cementing strength were summarized. And the following research results were obtained. First, when the inclination increases from 0° to 86°, the mud film thickness changes from uniform distribution to thin-and-thick distribution, and the area proportions of thinner and thicker mud films both increase. And especially at the inclination of 86°, the mud film thickness on the upper surface is very large, and there are large exposed areas on the left and right surfaces of the steel pipe. Second, the cementing strength at the casing-cement interface of the exposed casing is much higher than that at the interface with mud film. And with the increase of inclination, the cementing strength at the interface with mud film tends to increase. Third, with the increase of inclination, the interfacial cementing strength increases successively, which is closely related to the area proportion of the exposed steel pipe to the solid mud film on the outer surface. In conclusion, the exposed area of the simulated casing on the outer surface is a key factor affecting its interfacial cementing strength.

Number of references: 21

Main heading: Strength of materials

Controlled terms: Cementing (shafts) - Cements - Film thickness - Horizontal wells - Steel pipe

Uncontrolled terms: Area proportions - Cementing strength - Distribution law - Experimental devices - Inclination - Outer surface - Research results - Uniform distribution

Classification code: 412.1 Cement - 512.1.1 Oil Fields - 545.3 Steel - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.08.011

Database: Compendex

124.

Accession number: 20194807752654

Title: **Research, development and performance evaluation of XAI-180, a new acid corrosion inhibitor with high temperature resistance**

Title of translation: **新型耐高温酸化缓蚀剂XAI-180的研发与性能评价**

Authors: Li, Hui ; Luo, Bin ; Tang, Zubing ; Lan, Hangyuan ; Dai, Junqing

Author affiliation: Downhole Operation Company, Sinopec Southwest Petroleum Engineering Corporation Limited, Deyang; Sichuan; 618000, China

Sinopec Exploration Company, Chengdu; Sichuan; 610041, China

Corresponding author: Luo, Bin (23073481@qq.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: September 25, 2019

Publication year: 2019

Pages: 89-95

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to make corrosion inhibitors applicable to the harsh

working conditions of acidizing construction in high-temperature deep wells and improve their comprehensive performance of corrosion inhibition at high temperature, this paper took the combination of Mannich base quaternary ammonium salt and quinoline quarternary ammonium salt as the main inhibitor, and synergistically selected and prepared auxiliaries, e.g. synergists and auxiliary solvents. Then, the formula design of composite acid corrosion inhibitor XAI-180 with high temperature resistance was completed by means of orthogonal experiments. Finally, the corrosion inhibition performance of XAI-180 was evaluated by virtue of the weightlessness method and electrochemical test and analysis method. And the following research results were obtained. First, the combination of a self-made Mannich base quaternary ammonium salt inhibitor and a quinoline quaternary ammonium salt inhibitor presents an obvious synergistic effect, and the inhibition effect is the best when their ratio is 21:5. Second, the corrosion inhibitor XAI-180 with high temperature resistance is a kind of a mixed control inhibitor, which can inhibit both cathodic and anodic reactions. Third, when 5% acid corrosion inhibitor XAI-180 is added, under the temperature of 180 ℃, the corrosion rate of N80 steel sheet is 70 g/(m•h) in the conventional acid system with hydrochloric acid concentration of 20%, and 92.3 g/(m•h) and 95.8 g/(m•h) respectively in the system with 0.4% and 0.8% gallant. It is concluded that acid the corrosion inhibitor XAI-180 with high temperature resistance has the advantages of good compatibility and strong corrosion inhibition in a gelling acid system with hydrochloric acid concentration of 20% at 180 ℃, and it can meet the needs of acid fracturing in the reservoirs above 180 ℃.

Number of references: 17

Main heading: High temperature corrosion

Controlled terms: Acidization - Corrosion inhibitors - Corrosion rate - Hydrochloric acid - Salts - Steel corrosion - Temperature control

Uncontrolled terms: Acidizing - Auxiliaries - Main agent - Quaternary ammonium salt - Synergistic

Classification code: 539.1 Metals Corrosion - 731.3 Specific Variables Control - 802.2 Chemical Reactions - 803 Chemical Agents and Basic Industrial Chemicals - 804.2 Inorganic Compounds

Numerical data indexing: Percentage 2.00e+01%, Percentage 4.00e-01%, Percentage 5.00e+00%, Percentage 8.00e-01%

DOI: 10.3787/j.issn.1000-0976.2019.09.011

Database: Compendex

125.

Accession number: 20195107877628

Title: **2-D electrical resistivity tomography assessment of hydrate formation in sandy sediments**

Title of translation: **沉积物中天然气水合物生成过程的二维电阻层析成像观测**

Authors: Li, Yanlong ; Sun, Hailiang ; Meng, Qingguo ; Liu, Changling ; Chen, Qiang ; Xing, Lanchang

Author affiliation: Key Laboratory of Gas Hydrate, Ministry of Natural Resources, Qingdao Institute of Marine Geology, Qingdao; Shandong; 266071, China

Laboratory for Marine Mineral Resources, Qingdao National Laboratory for Marine Science and Technology, Qingdao; Shandong; 266071, China

Faculty of Engineering, China University of Geoscience, Wuhan; Hubei; 430074, China

College of Information and Control Engineering, China University of Petroleum-East China, Qingdao; Shandong; 266580, China

Corresponding author: Liu, Changling (qdliuchangling@163.com)

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Abbreviated source title: Natur. Gas Ind.

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Issue date: October 25, 2019

Publication year: 2019

Pages: 132-138

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Laboratory hydrate formation process simulation and its physical property evolution monitoring within the sediment provides a theoretical support for determining the dynamic revolution behaviors of actual hydrate reservoirs. In view of this, based on the ITS electrical resistance tomography (ERT) module, a dedicated apparatus was developed to simulate the in-situ core-

scale distribution of natural gas hydrate directly during the process of hydrate formation and dissociation in artificial sediments. Beach sand was used as porous media to simulate the formation of methane hydrate and assess the 2-D ERT evolution characteristics simultaneously. The findings were obtained. (1) The apparent average resistance values of hydrate-bearing sediment system are determined by the combination of hydrate forming rate and salt-removing effect, showing fluctuation rise behaviors during the process of hydrate formation. (2) When the hydrate forming rate is high enough, hysteresis influence of salt-removing effect on apparent average resistance value is observed. After the hydrate formation, there still exists a mass transfer process controlled by the difference of salt ion concentration. (3) Difference between original and real-time ERT distribution indicates a heterogeneous formation process of hydrate within the sediments. In conclusion, initial gas-water contact relationship and distribution is the virtual factors for hydrate heterogeneous distribution behaviors, while that of spatial difference of ion concentration caused by the salt-removing effect plays a key role in promoting local hydrate formation position change.

Number of references: 26

Main heading: Gas hydrates

Controlled terms: Electric conductivity - Electric resistance - Hydration - Mass transfer - Natural gas - Porous materials - Process monitoring - Sediments

Uncontrolled terms: Electrical conductivity - Electrical resistance tomography - Electrical resistivity tomography - Evolution characteristics - Heterogeneous distributions - Heterogeneous formation - Hydrate bearing sediments - Hydrate formation process

Classification code: 483 Soil Mechanics and Foundations - 522 Gas Fuels - 641.3 Mass Transfer - 701.1 Electricity: Basic Concepts and Phenomena - 913.1 Production Engineering - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.10.017

Database: Compendex

126.

Accession number: 20200208027877

Title: **Evaluation of working fluid damage in fractured reservoirs using flow rate instead of permeability**

Title of translation: **流量替代渗透率评价破碎性储层工作流体伤害程度**

Authors: Zheng, Lihui ; Liu, Hao ; Zeng, Hao ; Wu, Tong ; Zhang, Wenchang ; Wang, Chao

Author affiliation: China University of Petroleum, Beijing, Beijing; 102249, China

Sinopec Zhongyuan Oilfield Company, Puyang; Henan; 457001, China

Key Laboratory of Comprehensive Research and Application of Chemical Plugging Materials, Chemical Industry and Engineering Society of Hebei, Beijing LihuiLab Energy Technology Co., Ltd., Beijing; 102200, China

Corresponding author: Liu, Hao (tcliuhao666@163.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: December 25, 2019

Publication year: 2019

Pages: 74-80

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: A "sofigenthcarbon formation" is a subsurface pool of hydrocarbons contained in the rock formations that can be easily broken into irregular fractured bodies when the mechanical environment changes. Typically, it happens on low overall strength rocks with anisotropic property of seepage and stress, such as coal, carbonate, unconsolidated sandstone or fractured tight sandstone, shale. Due to the strong heterogeneity of fractured reservoirs in the vertical direction, it is difficult to reflect the overall reservoir damage degree caused by working fluids by testing the permeability change of a single core plug before and after the intrusion of working fluids. To this end, this paper took advantage of the Darcy's law to theoretically discuss the feasibility of replacing the permeability with the flow rates to quantitatively characterize the reservoir damage degree. Then, the flow test experiments were carried out on single-layer development, double-layer joint development and three-layer joint development to evaluate the overall damage degree of single-layer and multi-layer reservoirs by working fluids. Finally, the flow damage degree was compared with the permeability damage degree to verify the

feasibility of replacing permeability with flow rates. And the following research results were obtained. First, during the single-layer development, the flow-rate damage and the permeability damage are basically accordant, and the permeability damage degree is a special form of the flow-rate damage degree. Second, during the double-layer and three-layer joint development, the steady flow-rate damage degree of each layer is close to the permeability damage degree, and the flow-rate damage rate can quantitatively characterize the overall damage degree of jointly developed reservoirs, but the permeability damage degree cannot. Third, the steady flow-rate damage degree is closer to the permeability damage degree than the cumulative flow-rate damage degree. In conclusion, the determination of steady flow rates can be used as the substitute of permeability measurement to evaluate the damage degree of fractured reservoirs by working fluids, so as to provide a method and a basis for optimizing the engineering technology and evaluating the adaptability of working fluids.

Number of references: 17

Main heading: Flow rate

Controlled terms: Coal deposits - Fluids - Fracture - Mechanical permeability - Petroleum prospecting - Petroleum reservoir evaluation - Petroleum reservoirs - Sandstone - Steady flow

Uncontrolled terms: Carbonate rock - Coalbeds - Exploration and development - Fractured reservoir - Reservoir damage - Tight sandstones

Classification code: 482.2 Minerals - 503 Mines and Mining, Coal - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 631 Fluid Flow - 631.1 Fluid Flow, General - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.12.009

Database: Compendex

127.

Accession number: 20194207561206

Title: **Recent application progress of mud-logging support technologies for shale gas reservoirs**

Title of translation: **页岩气储层录井配套技术应用新进展**

Authors: Zheng, Majia ; Tang, Hongming ; Qu, Ziyi ; Liu, Xuemei ; Jia, Zhaoqing ; Xiao, Ping ; Luo, Xin ; Pang, Jiangping ; Wang, Ke

Author affiliation: School of Geosciences and Technology, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Shale Gas Exploration Department, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Geological Exploration and Development Research Institute, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

Sichuan Shale Gas Exploration and Development Co., Ltd., Neijiang; Sichuan; 641100, China

Development Department, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Sichuan Changning Natural Gas Development Co., Ltd., Yibin; Sichuan; 644300, China

Corresponding author: Tang, Hongming (swpithm@vip.163.com)

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Publication year: 2019

Pages: 41-49

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: After more than ten years of exploration and practices, the shale gas resources above the burial depth of 3 500 m in the southern Sichuan Basin has stepped into the stage of scale development. The sublayers of target layers in the shale gas reservoirs of Upper Ordovician Wufeng Formation-Lower Silurian Longmaxi Formation are defined, but how to realize batch optimal and fast drilling of horizontal well by means of mud-logging support technologies is currently one of the key issues to be investigated. To this end, the characteristics of shale gas reservoir of the Wufeng Formation-Longmaxi Formation in the Sichuan Basin were firstly analyzed in this paper. Then, combined with the mud-logging results of over 100 shale gas wells, a series of researches were carried out from the aspects of shale gas reservoir identification, sublayer division and evaluation method, and the mud-logging acquisition parameters suitable for shale gas evaluation were selected. In this way, the mud-logging support technologies for the identification and evaluation of shale gas reservoirs are developed. And the

following research results were obtained. First, the combination of element logging and gamma-ray energy spectrum logging can subdivide the target shale gas layers effectively, and combined with the gamma ray while drilling, it can assist the geosteering effectively, so as to ensure the targeting success ratio of shale gas horizontal wells and the timely adjustment of horizontal section trajectories. Second, the comprehensive application of element logging, gamma-ray energy spectrum logging, nuclear magnetic resonance logging and gas logging, combined with the shale gas reservoir evaluation criterion, can realize the division and quantitative evaluation of shale gas reservoirs and provide the support for the geosteering of horizontal wells. Third, the field application effect verifies that the mud-logging support technologies developed in this paper expand the application scope of mud logging technologies. By virtue of these mud-logging support technologies, shale gas reservoirs can be identified and evaluated quickly, the drilling operation in this area is under effective guidance, and the drilling rate of shale gas reservoirs is improved.

Number of references: 16

Main heading: Petroleum reservoir evaluation

Controlled terms: Energy resources - Gamma rays - Gases - Horizontal wells - Infill drilling - Mud logging - Nuclear magnetic logging - Petroleum prospecting - Petroleum reservoirs - Radioactivity logging - Shale gas - Spectroscopy - Stratigraphy

Uncontrolled terms: Evaluation while drillings - Geosteering - Sichuan Basin - Silurian - Stratigraphic division

Classification code: 481.1 Geology - 481.4 Geophysical Prospecting - 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 525.1 Energy Resources and Renewable Energy Issues - 931.3 Atomic and Molecular Physics

Numerical data indexing: Size 3.50e+03m

DOI: 10.3787/j.issn.1000-0976.2019.08.005

Database: Compendex

128.

Accession number: 20193207284610

Title: **Numerical simulation of rock breaking by PDC cutters in hot dry rocks**

Authors: Zhu, Xiaohua ; Dan, Zhaowang

Author affiliation: School of Mechatronic Engineering, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Geothermal Energy Research Center, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

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Volume: 39

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Issue date: April 25, 2019

Publication year: 2019

Pages: 125-134

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Penetrating through hot dry rocks for geothermal resources with high geothermal gradients, high degrees of hardness and abrasivity will be extremely difficult, and a reasonable tooth distribution is a key factor to improve its rock breaking efficiency. In order to explore an available cutter arrangement design of PDC cutters in hot dry rock drilling, we, based on elastic-plastic mechanics and rock mechanics, established a dynamic 3D numerical simulation model of rock breaking with PDC cutters by using the Drucker-Prager yield criterion as the rock strength judgment principle. On the basis of this, we studied, under the confining pressure of 60 MPa, the effects of cutting depth, temperature, back rake angle and cutting speed on the mechanical specific energy of PDC cutters. The following results were achieved. (1) When a PDC cutter cuts a rock with the speed of 0.5 m/s and the back rack angle of 5°-25°, the rock destruction specific energy of the cutter decreases significantly with the rise of cutting depth, while increases first and then decreases with the increasing temperature. And the critical temperature is 200℃. (2) When a PDC cutter cuts a rock with the speed of 0.5 m/s and the cutting depth of 1-3 mm, the rock destruction specific energy of the cutter decreases first and then increases with the increase of back rack angle. And the optimal rack angle is 20°. (3) Within the temperature range of 20-300℃, a PDC cutter cuts a rock with the back rack angle of 5°, the rock destruction specific energy of the cutter increases with the cutting speed but decreases with the increase of cutting depth.

Number of 32

references:

Main heading: Rocks

Controlled terms: Computer simulation - Cutting - Diamond drills - Elastoplasticity - Geothermal fields - Geothermal wells - Numerical models - Rock drilling - Rock mechanics - Temperature

Uncontrolled terms: Geothermal exploitation - Hot dry rock - Mechanical specific energies - PDC cutters - Rack angle - Rock breaking efficiencies - Yield criteria

Classification code: 481.3.1 Geothermal Phenomena - 483.1 Soils and Soil Mechanics - 641.1 Thermodynamics - 723.5 Computer Applications - 921 Mathematics

Numerical data indexing: Pressure 6.00e+07Pa, Size 1.00e-03m to 3.00e-03m, Velocity 5.00e-01m/s

DOI: 10.3787/j.issn.1000-0976.2019.04.017

Database: Compendex

129.

Accession number: 20193207285100

Title: **Theoretical insights, core technologies and practices concerning "volume development" of shale gas in China**

Authors: Jiao, Fangzheng

Author affiliation: China National Petroleum Corporation, Beijing; 100007, China

Corresponding author: Jiao, Fangzheng (lindp@cnpc.com.cn)

Source title: Natural Gas Industry

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Publication year: 2019

Pages: 1-14

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In recent years, major exploration breakthroughs and subsequent booming development of marine shale gas in both Upper Ordovician Wufeng and Lower Silurian Longmaxi Fms in the Sichuan Basin and its surroundings highlight the strategic importance for the theoretical innovation and technological advances of natural gas in China. A number of key theories and technologies, such as continuous hydrocarbon accumulation and horizontal well volume fracturing, and so on, have contributed to the large-scale development of shale gas fields such as Shunan, Fuling, etc., in Sichuan Basin. Based on China's geological conditions, industrial practices and current limitations in executing the full-scale development of shale gas, a new concept called "volume development (VD)" has been proposed. Under the framework of this theory, man-made volumetric fracture network systems are established through the combination of horizontal well drilling and transverse hydraulic fracturing through which gas flow become much more efficient due to the lateral flow superimposed by vertical fracture flow. VD has become a very efficient development model for shale gas because it can make natural gas in the volume affected by the man-made fracture network system become commercial reserves, and be produced more cost-effectively. VD includes five core technologies, i.e. integrated evaluation of "sweet areas", "optimization design of well patterns for volume development", "optimization and trajectory design of horizontal well drilling in target window", "massive fracturing technology for horizontal wellbores", "design of production system and platform-based well factory-like management". The VD theory and technology provides important theoretical basis and technical support not only for the present three-dimensional development of shale gas in Changning, Fuling and other nearby blocks, but for the overall utilization of unconventional oil and gas resources such as continental, transitional marine and continental facies shale gas. It is believed that VD will have broad application prospects in shale gas development.

Number of references: 32

Main heading: Proven reserves

Controlled terms: Energy resources - Flow of gases - Fracture - Gas industry - Gases - Horizontal drilling - Horizontal wells - Hydraulic fracturing - Infill drilling - Marine engineering - Natural gas - Oil bearing formations - Oil wells - Petroleum reservoir evaluation - Petroleum reservoirs - Shale gas - Stereo image processing - Well drilling

Uncontrolled terms: China - Compound gas - Continuous types - Fracture network - Gas reservoir - Sichuan Basin - Stereoscopic well layout - Sweet area (section) - Volume development

Classification 511.1 Oil Field Production Operations - 512.1.1 Oil Fields -

code: 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 525.1 Energy Resources and Renewable Energy Issues - 631.1.2 Gas Dynamics - 675 Marine Engineering - 723.2 Data Processing and Image Processing - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.05.001

Database: Compendex

130.

Accession number: 20195107877715

Title: **Evolution features of riverbeds near underwater crossing line pipes: An experimental study**

Title of translation: **水下穿越管道附近河床演变特性试验**

Authors: Yang, Qian ; Sun, Mingnan ; He, Mo ; Yang, Qinghua

Author affiliation: School of Civil Engineering, Southwest Jiaotong University, Chengdu; Sichuan; 610031, China

Institute of Safety, Environment Protection and Technical Supervision, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Corresponding author: Yang, Qinghua (qhyang@home.swjtu.edu.cn)

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Publication year: 2019

Pages: 110-117

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: It is of important significance to study the evolution law of the riverbed near underwater crossing line pipes for ensuring the safe operation of oil and gas pipelines and reducing the risk of damage by water flood disasters. In order to clarify the evolution law of the riverbed near underwater crossing line pipes and its negative effects, this paper conducted flume model experiments

on underwater crossing line pipes. The physical process of riverbed evolution near pipes was observed and the effect of hydrodynamic conditions on the local pipe scour was studied. What's more, the formation mechanism of local scour at underwater crossing line pipes was revealed. And the following research results were obtained. First, when the water flow is slow, the riverbed evolution process near underwater crossing line pipes is mainly divided into six stages, including riverbed undercutting, pipe exposure, micro-pore formation, scour hole propagation, pipe suspension and scour equilibrium. Second, Vortex and seepage flow are the reasons for the local scour of underwater crossing line pipes. Before pipes are exposed, the silt around the pipes is reduced by vortex. After pipes are exposed, micro-pores occur at the pipe bottom under the joint action of vortex and seepage flow. And thus, local scour is formed. Third, flow velocity and water depth jointly influence the riverbed scour duration of each stage and the maximum scour depth at the pipe bottom. When the Froude number (Fr) is in the range of 0.306–0.808, with the increase of Fr, water flow gets fast, the maximum scour depth at the pipe bottom increases, the duration for scour equilibrium decreases, the riverbed undercutting depth increases and the riverbed topographically gets flatter. The maximum scour depth at the pipe bottom is 0.9 –1.6 times the pipe diameter, and the duration for scour equilibrium is between 1 650 min and 2 620 min. In conclusion, the experimental results provide important reference for predicting the burial depth of underwater crossing line pipes and ensuring their safe operation.

Number of references: 27

Main heading: Crossings (pipe and cable)

Controlled terms: Bridge piers - Flow of water - Flow velocity - Hydraulics - Hydrodynamics - Scour - Seepage - Steady flow - Suspensions (fluids) - Vortex flow - Water resources

Uncontrolled terms: Crossing Lines - Flume experiment - Hydrodynamic conditions - Riverbed evolution - Scour depth

Classification code: 401.1 Bridges - 444 Water Resources - 631 Fluid Flow - 632.1 Hydraulics - 804 Chemical Products Generally - 951 Materials Science

Numerical data indexing: Time 9.90e+04s to 1.57e+05s

DOI: 10.3787/j.issn.1000-0976.2019.10.014

Database: Compendex

131.

Accession number: 20193907482168

Title: **Fast and efficient drilling technologies for deep shale gas horizontal wells in the sichuan Basin: A case study of Well Lu 203**

Title of translation: **四川盆地深层页岩气水平井优快钻井技术--以泸203井为例**

Authors: Zheng, Shuquan ; Xie, Xiangfeng ; Luo, Liangyi ; Jing, Yang ; Tang, Meng ; Yang, Ruifan ; Zhong, Guangrong ; Wang, Jun ; Chen, Zhengyun

Author affiliation: Chuandong Drilling Company, CNPC Chuanqing Drilling Engineering Co., Ltd., Chongqing; 401147, China

Drilling & Production Technology Research Institute, CNPC Chuanqing Drilling Engineering Co., Ltd., Guanghan; Sichuan; 618300, China

Corresponding author: Chen, Zhengyun (chenzy1_sc@cnpc.com.cn)

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Volume: 39

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Publication year: 2019

Pages: 88-93

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Well Lu 203 is an important ultradeep shale gas exploration well which is deployed by the CNPC in the Luxian-Changning Shale Gas Block of the southern Sichuan Basin. Its total well depth is 5 600 m and its daily gas production during the test is 137.9×10 m. At present, it is domestic first shale gas well whose single-well daily production is over one million cubic meters. In this paper, Well Lu 203 was taken as an example to provide the technologies and experience for the fast and efficient drilling of deep shale gas wells. After the drilling requirements based on reservoir characteristics were analyzed, the comprehensive support technologies of fast and efficient drilling to ensure the wellbore quality, high-quality reservoir drilling rate and fast drilling of shale gas horizontal wells and reduce the complex

accident rate were summarized and their application effects were evaluated. And the following research results were obtained. First, rotary steering tools, combined with drill string torsion system can reduce the sliding directional drilling footage, successfully control the backing pressure of drilling tools and greatly save the orientation assistance time. Second, the four measures which were taken to reduce the vibration of the drilling tools can well solve the problem of screw failure during horizontal section drilling and increase the rate of penetration (ROP) further. Third, the near-bit gamma measurement system is used to track the reservoirs in real time and control the drilling trajectory in the high-quality production layers so as to ensure the high-quality shale drilling rate. Fourth, the application of well-equipped drilling equipment and high-density oil-based drilling fluid ensures the dynamic of the downhole power drilling tool and the purification of the drilling fluid performance, satisfies the need of sand carrying in the wellbore, guarantees the smooth flow of the wellbore, maintains the stability of the wellbore, and plays an important role in ROP improvement. In conclusion, according to the technical idea of geology-engineering integration, Well Lu 203 is drilled in the mode of drilling the vertical pilot hole first and then sidetracking the horizontal well, and its high-quality reservoir drilling rate is up to 100%. The implementation of the Well Lu 203 further improves the support drilling technologies for the fast and efficient drilling of ultradeep shale gas horizontal wells in the new blocks of the Sichuan Basin.

Number of references: 19

Main heading: Oil well drilling

Controlled terms: Boreholes - Drill strings - Drilling equipment - Drilling fluids - Gases - Geological surveys - Horizontal drilling - Horizontal wells - Infill drilling - Lutetium - Lutetium compounds - Natural gas well production - Natural gas wells - Oil wells - Petroleum prospecting - Quality control - Shale gas

Uncontrolled terms: Deep zone - Drilling technology - Gamma measurements - Rotary steering - Sichuan Basin

Classification code: 481.1 Geology - 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512 Petroleum and Related Deposits - 522 Gas Fuels - 547.2 Rare Earth Metals - 913.3 Quality Assurance and Control

Numerical data indexing: Percentage 1.00e+02%, Size 5.60e+03m

DOI: 10.3787/j.issn.1000-0976.2019.07.011

Database: Compendex

132.

Accession number: 20193907482171

Title: **Mechanism and dynamic process evolution of bottomhole rock burst in nitrogen drilling**

Title of translation: **氮气钻井井底岩爆机理及动态过程演化**

Authors: Luo, Chengbo ; Meng, Yingfeng ; Li, Gao ; Liu, Houbin ; Yang, Xu ; Lin, Nan

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Bazhou Drilling Company, CNPC Xibu Drilling Engineering Co., Ltd., Bazhou; Xinjiang; 841000, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Bottomhole rock burst caused by fracture trap high pressure in tight sandstone during nitrogen drilling is the root cause of the vicious blowout accident in Well QL1. In order to restore the sound development of gas drilling technology, it is in an urgent need to analyze the mechanisms of rock burst systematically and establish the accurate understanding. In this paper, the mechanisms of bottomhole rock burst were studied using conventional wellbore instability analysis methods after the properties of the rocks at the bottomhole were analyzed and the fracture plane stress of the rocks at the bottomhole was calculated. Then, the dynamic evolution of rock burst was simulated with the help of Visual Basic language and Matlab software programming. Finally, abnormal change of logging monitoring parameters of Well QL1 was analyzed. And it is indicated that as the bottomhole gradually approaches the

fracture trap high pressure, the difference value between circumferential stress of surface plane and radial stress increases gradually; and that the increase of shear stress caused by the difference value of the principal stresses leads to shear failure or tension failure at the fracture plane until the failure zone is connected with the wellbore, then high pressure gas swarms into the wellbore with a lot of rock debris, releasing a large amount of energy, and consequently bottomhole rock burst happens and displaces upward to compress the drilling tools. In conclusion, the research results systematically explain the abnormal change of logging monitoring parameters of Well QL1 and the analysis methods provide a theoretical basis for bottomhole rock burst prevention and control.

Number of references: 15

Main heading: Oil field equipment

Controlled terms: Boreholes - Dynamics - Elastoplasticity - Fracture - Infill drilling - MATLAB - Nitrogen - Rock bursts - Rocks - Shear stress - Visual BASIC - Visual languages

Uncontrolled terms: Bottomhole - Circumferential stress - Effective stress - Elastic-plastic stress - Gas drilling technologies - High pressure - Monitoring parameters - Rock burst preventions

Classification code: 502.1 Mine and Quarry Operations - 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 723.1.1 Computer Programming Languages - 804 Chemical Products Generally - 921 Mathematics - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.07.013

Database: Compendex

133.

Accession number: 20195107877631

Title: **Effect of acidizing treatment on microstructures and mechanical properties of shale**

Title of translation: **酸处理对页岩微观结构及力学性质的影响**

Authors: Lu, Cong ; Ma, Li ; Guo, Jianchun ; Xiao, Senwen ; Zheng, Yunchuan ; Yin, Congbin

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Downhole Operation Company, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

Source title: Natural Gas Industry
Abbreviated source title: Natur. Gas Ind.
Volume: 39
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Issue date: October 25, 2019
Publication year: 2019
Pages: 59-67
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency
Number of references: 20
Main heading: Mechanical permeability
Controlled terms: Acidization - Compressive strength - Dissolution - Elastic moduli - Elastoplasticity - Fracture - Fracture mechanics - Low permeability reservoirs - Mechanical properties - Microstructure - Petroleum reservoir engineering - Pore size - Porosity - Scanning electron microscopy - Shale
Uncontrolled terms: Acidizing treatment - Elastic-plastic deformation - Laboratory test - Mechanical parameters - Microstructures and mechanical properties - Reservoir permeability - Sichuan Basin - Weiyuan Block
Classification code: 512.1 Petroleum Deposits - 512.1.2 Petroleum Deposits : Development Operations - 802.2 Chemical Reactions - 802.3 Chemical Operations - 931.1 Mechanics - 931.2 Physical Properties of Gases, Liquids and Solids - 951 Materials Science
Numerical data indexing: Percentage 1.50e+01%, Percentage 3.28e+01%, Percentage 5.01e+01%, Percentage 5.81e+01%, Time 1.44e+04s
DOI: 10.3787/j.issn.1000-0976.2019.10.007
Database: Compendex

134.

Accession number: 20195107877584

Title: **A new fracturing technology of intensive stage + high-intensity proppant injection for shale gas reservoirs**

Title of translation: **页岩气密切割分段+高强度加砂压裂新工艺**

Authors: Zheng, Youcheng ; Fan, Yu ; Yong, Rui ; Zhou, Xiaojin

Author affiliation: PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Shale Gas Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 17

Main heading: Fracture

Controlled terms: Horizontal wells - Injection (oil wells) - Petroleum reservoirs - Productivity - Proppants - Shale gas

Uncontrolled terms: Casing deformation - Changning Block - High intensity - Induced stress - Sichuan Basin

Classification code: 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 522 Gas Fuels - 951 Materials Science

Numerical data indexing: Size 3.50e+03m

DOI: 10.3787/j.issn.1000-0976.2019.10.009

Database: Compendex

135.

Accession number: 20193207285056

Title: **Description and prevention & control technical countermeasures of water flooding risk in water-drive gas reservoirs**

Authors: Li, Jiangtao ; Sun, Lingyun ; Xiang, Yiwei ; Li, Runtong ; Wang, Haicheng ; Chen, Fangfang

Author affiliation: PetroChina Qinghai Oilfield Company, Dunhuang; Gansu; 736202, China

PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Source title: Natural Gas Industry

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 16

Main heading: Floods

Controlled terms: Factor analysis - Gas hazards - Gas industry - Gases - Petroleum reservoirs - Proven reserves - Reservoirs (water) - Risk assessment - Secondary recovery

Uncontrolled terms: Flooding risks - Gas field development - Gas reservoir - Prevention and controls - Producible reserves - Production increase - Technical countermeasures - Transfer countermeasure

Classification code: 441.2 Reservoirs - 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 914.1 Accidents and Accident Prevention - 922.2 Mathematical Statistics

DOI: 10.3787/j.issn.1000-0976.2019.05.009

Database: Compendex

136.

Accession number: 20193607404626

Title: **A dynamic prediction model of pressure control production performance of shale gas fractured horizontal wells and its application**

Authors: Jia, Ailin ; Wei, Yunsheng ; Liu, Cheng ; Wang, Junlei ; Qi, Yadong ; Jia, Chengye ; Li, Bo

Author affiliation: PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

PetroChina Zhejiang Oilfield Company, Hangzhou; Zhejiang; 310023, China

Huaneng International Power Development Corporation, Beijing; 100032, China

Corresponding author: Wang, Junlei (wangjunlei@petrochina.com.cn)

Source title: Natural Gas Industry

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Volume: 39

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Pages: 71-80

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 23

Main heading: Gas industry

Controlled terms: Fracture - Gas engineering - Gases - Horizontal wells - Natural gas well production - Numerical models - Petroleum reservoirs - Pressure control - Shale gas

Uncontrolled terms: Cumulative gas productions - Fractured horizontal wells - Gas productions - Nonlinear flow - Variable stress

Classification code: 512.1.1 Oil Fields - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 731.3 Specific Variables Control - 921 Mathematics - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.06.008

Database: Compendex

137.

Accession number: 20193207285079

Title: **A discussion on the construction of China's natural gas marketing system under the new situations**

Authors: Liu, Zhongyun

Author affiliation: Sinopec Group, Beijing; 100728, China

Corresponding author: Liu, Zhongyun (xujj@sinopec.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Pages: 137-144

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 19

Main heading: Commerce

Controlled terms: Competition - Gases - Management - Marketing - Natural gas

Uncontrolled terms: China - Client - Key elements - New situation - System construction

Classification code: 522 Gas Fuels - 911.2 Industrial Economics - 911.4 Marketing - 912.2 Management

DOI: 10.3787/j.issn.1000-0976.2019.05.017

Database: Compendex

138.

Accession number: 20193207284673

Title: **Compaction and embedment characteristics of proppant in hydraulic fractures of coal seams**

Authors: Huang, Bingxiang ; Li, Haoze ; Cheng, Qingying ; Zhao, Xinglong

Author affiliation: State Key Laboratory of Coal Resources and Safe Mining, China University of Mining and Technology, Xuzhou; Jiangsu; 221116,

China

Jiangsu Key Laboratory of Fire Safety in Urban Underground Space, China University of Mining and Technology, Xuzhou; Jiangsu; 221116, China

Corresponding author: Li, Haoze (18361279674@163.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: April 25, 2019

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Pages: 48-54

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 22

Main heading: Proppants

Controlled terms: Coal - Coal deposits - Compaction - Embeddings - Fracture - Hydraulic fracturing

Uncontrolled terms: Closure stress - Coal seams - Critical pressures - Embedded - Embedding process - Flow conductivity - Proppant - Single fracture

Classification code: 503 Mines and Mining, Coal - 511.1 Oil Field Production Operations - 512.1.2 Petroleum Deposits : Development Operations - 524 Solid Fuels - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.04.006

Database: Compendex

139.

Accession number: 20193207284492

Title: **Obstacles to the development of CBM industry and countermeasures in China**

Authors: Zhang, Sui'an ; Zhang, Diankun ; Peng, Chuan ; Yuan, Yu

Author affiliation: CBM Research Center, China University of Petroleum, Beijing;

102249, China

State Key Laboratory of Coal and Coalbed Methane Co-mining, Jincheng; Shanxi; 048000, China

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Abbreviated source title: Natur. Gas Ind.

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Pages: 118-124

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 18

Main heading: Economic and social effects

Controlled terms: Accident prevention - Coal - Coal bed methane - Coal deposits - Coal industry - Coal mines - Gas industry - Green manufacturing - Industrial economics - Investments - Methane - Petroleum prospecting - Public policy - Technology transfer

Uncontrolled terms: China - Countermeasure - Economy - Industrial development - Obstacle

Classification code: 503 Mines and Mining, Coal - 503.1 Coal Mines - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 524 Solid Fuels - 804.1 Organic Compounds - 911.2 Industrial Economics - 914.1 Accidents and Accident Prevention - 971 Social Sciences

DOI: 10.3787/j.issn.1000-0976.2019.04.016

Database: Compendex

140.

Accession number: 20192607106209

Title: **A critical desorption time method to improve the calculation accuracy of gas loss in shale gas content testing**

Title of **提高页岩含气量测试中损失气量计算精度的解吸临界时间点法**

translation:

Authors: Liu, Gang ; Zhao, Qianping ; Gao, Chao ; Jiang, Lei ; Sun, Jianbo ; Liu, Chao

Author affiliation: Research Institute, Shaanxi Yanchang Petroleum <Group> Co., Ltd., Xi'an; Shaanxi; 710065, China

Oil and Gas Exploration Company, Shaanxi Yanchang Petroleum <Group> Co., Ltd., Yan'an; Shaanxi; 716000, China

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Volume: 39

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Issue date: February 25, 2019

Publication year: 2019

Pages: 71-75

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: During the conventional coring in shale gas reservoirs, a large amount of gas is lost, so it is difficult to estimate the lost gas content accurately. And consequently, the evaluation of shale gas content is deviated more from the real values. In this paper, the applicability of existing estimation methods for lost shale gas content calculation was firstly evaluated. Then, a critical desorption time method suitable for estimating the lost shale gas content was developed based on the gas diffusion principle in the process of core extraction. Afterwards, based on the measured desorption data of conventional coring samples of one shale gas well from the 7 Member of Yanchang Formation of Upper Triassic, Mesozoic in the Ordos Basin, the lost shale gas content was calculated by using the USBM method, polynomial function method and critical desorption time method, respectively. Finally, the calculation results were compared with the measured gas content of the pressure coring samples from the same horizon in this well. And the following research results were obtained. First, there is a linear relation between the cumulative desorbed gas and the square root of the diffusion time before the critical desorption time, and the slope of the trend line is the same. After this time point, there is a late non-equilibrium dif fusion stage, when the collected desorp - tion data present that the non-linear relation and the desorption curves are parallel to each other. Second, the shale gas content

calculated by the critical desorption time method was closer to the measured shale gas content of pressure coring samples. In conclusion, the critical desorption time method is more applicable to shale gas content testing, and it can increase the calculation accuracy of shale gas content significantly.

Number of references: 19

Main heading: Gases

Controlled terms: Desorption - Metamorphic rocks - Petroleum reservoirs - Shale gas

Uncontrolled terms: Calculation accuracy - Desorption time - Gas content - Gas loss - Late Triassic - Ordos Basin

Classification code: 512.1.1 Oil Fields - 522 Gas Fuels - 802.3 Chemical Operations

DOI: 10.3787/j.issn.1000-0976.2019.02.010

Database: Compendex

141.

Accession number: 20192607089036

Title: **Higher-order Knudsen's permeability correction model for rarefied gas in micro-scale channels**

Title of translation: **微尺度通道内稀薄气体高阶努森数渗透率修正模型**

Authors: Lu, Yinbin

Author affiliation: College of Mechanical Engineering, Xi'an Shiyou University, Xi'an; Shaanxi; 710065, China

Corresponding author: Lu, Yinbin (yblu@xsyu.edu.cn)

Source title: Natural Gas Industry

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Issue date: March 25, 2019

Publication year: 2019

Pages: 65-71

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Rarefaction effect appears when gas flows in micro- or nano-scale channels, so it is difficult to accurately predict the real gas flow rate by using the classical theory. To solve this problem, it is necessary to establish a more accurate and universal permeability correction model to describe the flowing behavior of rarefied gas. In this paper, the gas flow in a parallel microchannel was numerically simulated using R26 moment method, and the simulation results were compared with those of the direct simulation Monte Carlo method (DSMC method) and R13 moment method. Then, a gas permeability correction model for parallel microchannels and circular microtubes was established based on the simulation results of the R26 moment method, and used to describe the flowing behavior of rarefied gas in micro-scale channels. Finally, the gas permeability correction coefficient for different Knudsen numbers was calculated and compared with the prediction results of the Tang model, the experimental data and the solution of linearized Boltzmann equation. And the following research results were obtained. First, when the R26 moment method is used to describe the rarefaction effect of gas, its result is accordant with the calculation result of the DSMC method, and its calculation accuracy is higher than that of R13 moment method. Second, the gas permeability correction coefficient which is calculated by using the higher-order Knudsen's gas permeability correction model for parallel microchannels is in accordance with the experimental data and the solution of linearized Boltzmann equation. Third, the gas permeability correction coefficient which is calculated by using the higher-order Knudsen's gas permeability correction model for circular microtubes is accordant with the solution of linearized Boltzmann equation. In conclusion, this higher-order Knudsen's gas permeability correction model is advantageous with high prediction precision and universality, and it can be used to describe the rarefaction effect of gas in micro/nano-scale channels.

Number of references: 39

Main heading: Gas permeability

Controlled terms: Boltzmann equation - Flow of gases - Forecasting - Gases - Linearization - Method of moments - Microchannels - Monte Carlo methods - Nanotechnology - Shale gas

Uncontrolled terms: Correction models - Knudsen numbers - Prediction precision - Rarefied gas - Universality

Classification 522 Gas Fuels - 631.1.2 Gas Dynamics - 761 Nanotechnology -

code: 921 Mathematics - 922 Statistical Methods - 922.2 Mathematical Statistics - 931.2 Physical Properties of Gases, Liquids and Solids

DOI: 10.3787/j.issn.1000-0976.2019.03.008

Database: Compendex

142.

Accession number: 20192607089038

Title: **Structural parameters optimization of compression packer rubber based on orthogonal test**

Title of translation: **基于正交试验的压缩式封隔器胶筒的结构参数优化**

Authors: Zhang, Zhi ; Zhu, Xiaohua ; Xu, Jianbo

Author affiliation: Chengdu Zhongteng Petroleum Engineering Technology Co., Ltd., Chengdu; Sichuan; 610500, China

School of Mechatronic Engineering, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Downhole Operation Company, Sinopec Shengli Oilfield Service Corporation, Dongying; Shandong; 257000, China

Corresponding author: Zhu, Xiaohua (zxhth113@163.com)

Source title: Natural Gas Industry

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Publication year: 2019

Pages: 80-84

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: When the packer rubber which is mainly used to seal the tubing-casing annulus is applied on site, it often suffers seal failure and tear failure. In this paper, a 3D finite element calculation model for compression packer rubber was established based on the virtual work principle, Von Mises yield criterion and nonlinear contact theory to deal with above mentioned problems. By using

the orthogonal optimization method, the key structural parameters of packer rubber (length, thickness and chamfering dimension) were optimized and their optimal combination scheme was prepared. In addition, the mechanical property of packer rubber before and after the optimization was analyzed and compared. And the following research results were obtained. First, the factors influencing the sealing performance of packer rubber are ranked from the top to the bottom as thickness, chamfering dimension and length. Second, the optimal combination of the key structural parameters of the packer rubber is: length 80 mm, thickness 20 mm and chamfering dimension 10 mm. Third, after optimization, the maximum contact stress between a packer rubber and a casing is increased by 70.44% on average, the maximum Mises stress of the packer rubber is decreased by 15.72% on average, and the compression distance is decreased by 37.82% on average. Fourth, under the same setting load, the optimized packer rubber increases the contact pressure between the packer rubber and the casing and reduces the Mises stress of the packer rubber itself. In conclusion, the optimized packer rubber can better satisfy the on-site requirements of sealing performance and service life.

Number of references: 16

Main heading: Seals

Controlled terms: Packers - Rubber - Service life - Structural optimization

Uncontrolled terms: Contact Stress - Non-linear contact theories - Orthogonal optimizations - Sealing performance - Structural parameter - Virtual work principle - Von Mises stress - Von Mises yield criterion

Classification code: 511.2 Oil Field Equipment - 619.1.1 Pipe Accessories - 818.1 Natural Rubber - 921.5 Optimization Techniques

Numerical data indexing: Percentage 1.57e+01%, Percentage 3.78e+01%, Percentage 7.04e+01%, Size 1.00e-02m, Size 2.00e-02m, Size 8.00e-02m

DOI: 10.3787/j.issn.1000-0976.2019.03.010

Database: Compendex

143.

Accession number: 20192206992456

Title: **Characteristics and controlling factors of deep buried-hill reservoirs in the BZ19-6 structural belt, Bohai Sea area**

Title of translation: **渤海海域渤中19-6构造带深层潜山储层特征及其控制因素**

Authors: Hou, Mingcai ; Cao, Haiyang ; Li, Huiyong ; Chen, Anqing ; Wei, Ajuan ; Chen, Yang ; Wang, Yuechuan ; Zhou, Xuewei ; Ye, Tao

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

Institute of Sedimentary Geology, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

Tianjin Branch Company of CNOOC, Tianjin; 300452, China

Corresponding author: Cao, Haiyang (chycdut@163.com)

Source title: Natural Gas Industry

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The BZ19-6 deep buried-hill structural belt in the southwest of Bozhong Sag, Bohai Bay Basin, is a newly discovered supergiant oil and gas bearing area. The study on its reservoirs is still in the early stage, and the characteristics and control factors of reservoir development are not understood deeply. In this paper, cores, sidewall cores, rock sections were analyzed and described. Then, based on regional structural setting, mud logging and logging data, the buried-hill reservoirs in this area were analyzed from the aspects of petrological characteristics, reservoir space types and physical properties, the inherent factors influencing the development of the reservoirs were discussed, and distribution laws of the reservoirs were investigated. And the following research results were obtained. First, the deep buried-hill reservoirs of this belt are a pan-buried hill reservoir system composed of the Palaeocene-Eocene Kongdian Fm glutenite in the upper part and the Archean buried-hill metamorphic granite in the lower part. A multi-layer reservoir structure of glutenite pore zone, weathering crust dissolution fracture zone and inner fracture zone is formed. These reservoirs are complex in genesis and diverse in type. Second, the Archean buried-hill metamorphic granite reservoir can be vertically divided into

weathering crust, inner fracture zone and tight zone, and it presents the dual characteristics of porous and fractured media. Third, the buried-hill weathering crust is mainly affected by strong dissolution and leaching superimposed with fracturing, forming fractured-porous reservoir space. The reservoir of inner fracture zone is mainly controlled by the superimposition of three-phrase fractures, which forms the main development period of buried-hill fractures since the Yanshanian. Fourth, the glutenite of Kongdian Fm is a typical sieve deposit and it is mainly controlled by the late dissolution. Fifth, migmatization and supercritical fluid cryptoexplosion play a constructive role in the development of the reservoirs. In conclusion, the understanding of buried-hill glutenite and metamorphic reservoir system developed in this belt is conducive to determining the target and direction of next oil and gas exploration in this area.

Number of references: 39

Main heading: Fracture

Controlled terms: Dissolution - Effluent treatment - Granite - Mud logging - Offshore gas fields - Oil well logging - Petroleum deposits - Petroleum prospecting - Supercritical fluids - Weathering

Uncontrolled terms: Archean - Bohai Bay Basin - Bohai Sea - Paleogene - Structural belt - Structural fracture

Classification code: 452.4 Industrial Wastes Treatment and Disposal - 512 Petroleum and Related Deposits - 802.3 Chemical Operations - 931.2 Physical Properties of Gases, Liquids and Solids - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.01.004

Database: Compendex

144.

Accession number: 20192206992457

Title: **Geochemical characteristics and sources of oil and gas in deep buried hills, Bohai Sea area**

Title of translation: **渤海海域深层潜山油气地球化学特征及油气来源**

Authors: Li, Huiyong ; Xu, Yunlong ; Wang, Feilong ; Luo, Xiaoping ; Yu, Haibo

Author affiliation: Tianjin Branch Company of CNOOC, Tianjin; 300452, China

State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Chengdu University of Technology, Chengdu;

Sichuan; 610059, China

College of Energy, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

Corresponding author: Xu, Yunlong (xuylcdut@163.com)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Many hydrocarbon-rich deep subsags are developed in the periphery of the BZ19-6 deep buried-hill structural belt in the Bohai Sea area, Bohai Bay Basin, and their hydrocarbon accumulation conditions are complicated. So far, the organic geochemical characteristics and main sources of their oil and gas have not been figured out. In this paper, the geochemical characteristics of crude oil and natural gas in this belt and those of the source rocks of hydrocarbon-rich deep subsags around the buried-hill structure belt were analyzed by means of geochemical testing technologies, such as saturated hydrocarbon and light hydrocarbon chromatography, chromatography-mass spectrometry, detection of natural gas components and carbon isotope components. Then, the sources and characteristics of oil and gas in the BZ19-6 deep buried-hill structural belt were studied systematically by using the oil-source biomarker analysis technology. And the following research results were obtained. First, in the peripheral sags of this belt are mainly developed four sets of source rocks, i.e., the lower submember of the second Member of Paleogene Dongying Fm (E2d2), the third Member of Dongying Fm (E2d3), the first Member of Shahejie Fm (E2s1) and the upper submember of the third Member of Shahejie Fm (E2s3). Among them, E2d3 and E2s3 are the principal hydrocarbon source kitchens. Their organic abundance is relatively high and their organic matter is of sapropel-prone mixed type. And now they are in the peak stage of hydrocarbon generation. Second, natural gas in the Archean deep buried hill and its overlying

Paleogene Kongdian Fm (E1k) is typical oiltype gas. It presents the mixed characteristics of natural gas with different maturities and multiple stages of hydrocarbon accumulation process. Third, the source of oil and gas in shallow layers is different from that in deep layers, though they both present the mixed source input characteristics of three sets of source rocks. The oil and gas in shallow layers is mainly derived from E2d3 source rocks and possibly from E2d2 source rocks, while the oil and gas in deep layers is mainly derived from E2s3 source rocks. In conclusion, the hydrocarbon source conditions in this area are complex, the hydrocarbon source is mainly contributed by the E2s3 source rocks in the hydrocarbon-rich deep subsags in the periphery of this belt, and the deep condensate gas reservoirs are characterized by multi-stage oil-type gas input.

Number of references: 38

Main heading: Gas chromatography

Controlled terms: Biomarkers - Exploratory geochemistry - Gases - Hydrocarbons - Mass spectrometry - Natural gas - Offshore gas fields - Oils and fats - Petroleum reservoirs - Rocks - Testing

Uncontrolled terms: Bohai Bay Basin - Bohai Sea - Buried hill - Hydrocarbon sources - Oil-source correlation - Organic geochemistry - Southern Bozhong Sag

Classification code: 481.2 Geochemistry - 512.1.1 Oil Fields - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 801 Chemistry - 802.3 Chemical Operations - 804.1 Organic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.01.005

Database: Compendex

145.

Accession number: 20193607404595

Title: **Stress and deformation characteristics of completion and testing tubing string with expansion joints for ultra-deep HTHP gas wells**

Authors: Yang, Xiangtong ; Shen, Xinpu ; Cui, Xiaohu ; Wang, Kelin ; Shen, Guoyang ; Wang, Zhaobing ; Qin, Tao

Author affiliation: Oil and Gas Engineering Institute, PetroChina Tarim Oilfield Company, Korla; Xinjiang; 841000, China

China University of Petroleum <East China>, Qingdao; Shandong; 266555, China

Tianjin Chenxing Engineering Technology Co., Ltd., Tianjin;

300021, China

PetroChina Qinghai Oilfield Company, Xining; Qinghai; 736202, China

Corresponding author: Shen, Xinpu (xinpushen@yahoo.com)

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In Well MJ4, Tarim Basin, the testing tubing string is 6 617 m long and the bottom-hole pressure during the testing is 101.63 MPa. During the completion job, plastic deformation occurs in the tubing string, so it is very necessary to figure out at which stage of the completion job plastic deformation occurs on earth. For this reason, the three-dimension finite element analysis method was used to perform numerical calculations for the deformation of tubing string and the distribution of axial stress based on three typical load conditions (setting load, fracturing load, and well testing load of Well MJ4); a process for calculating the mechanical behavior of a completion and testing tubing string containing an expansion joint was then developed. The study content mainly includes: (1) A criterion was developed to determine the extension and closure status of the expansion joint in the tubing string; corresponding calculation mechanism and formulae were provided; and the extension-closure status of the expansion joint in the tubing string for Well MJ4 was calculated. (2) A method was developed for analyzing and calculating the additional pressure difference load in the packer annulus caused by poor engagement of the hydraulic anchor; the impact of the additional pressure difference load on the deformation behavior of the tubing string was simulated; and the significant impact of the additional pressure difference load on the plastic buckling deformation was figured out. (3) The limit of lateral buckling deformation in a calculation model was introduced, and so the impact of collar rigidity on the buckling deformation was indirectly considered; the deformation under

the joint action of all loads of the tubing string was calculated, and the numerical result was the same as the observed deformation. The study results show that the plastic deformation of the tubing string for Well MJ4 occurs at the fracturing stage and the major causes are hydraulic pressure loads and gravity loads in different forms. The conclusion shows that the mechanical calculation model of the testing tubing containing the expansion joint can be used as an important theoretical tool and analysis approach in optimizing operations and designing the tubing string structure.

Number of references: 15

Main heading: Well testing

Controlled terms: Bottom hole pressure - Buckling - Computer simulation - Expansion joints - Natural gas well completion - Numerical methods - Plastic deformation - Tubing

Uncontrolled terms: Completion tubing strings - Deformation behavior - Finite element analysis method - HTHP - Mechanical calculation models - Numerical calculation - Pressure differences - Stress and deformation

Classification code: 408.2 Structural Members and Shapes - 512 Petroleum and Related Deposits - 512.2.2 Natural Gas Deposits: Development Operations - 619.1 Pipe, Piping and Pipelines - 723.5 Computer Applications - 921.6 Numerical Methods

Numerical data indexing: Pressure 1.02e+08Pa, Size 6.62e+03m

DOI: 10.3787/j.issn.1000-0976.2019.06.011

Database: Compendex

146.

Accession number: 20193907482181

Title: **A prevention and control method for natural gas hydrate in pipe strings during deepwater gas well production tests**

Title of translation: **深水气井测试求产阶段管柱内天然气水合物防治方法**

Authors: Li, Xiangfang ; Liu, Wenyuan ; Liu, Shujie ; Hu, Jinqiu ; Nan, Yufeng ; Tian, Tian ; Zhou, Yunjian

Author affiliation: College of Petroleum Engineering, China University of Petroleum, Beijing; 102249, China

College of Safety and Ocean Engineering, China University of Petroleum, Beijing; 102249, China

CNOOC Research Institute Co., Ltd., Beijing; 100028, China

PetroChina Oil & Gas Pipeline Control Center, Beijing; 100007, China

Corresponding author: Liu, Wenyuan (wenyuan_liu@126.com)

Source title: Natural Gas Industry

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Language: Chinese

ISSN: 10000976

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The prevention and control of natural gas hydrate (hereinafter, "hydrate" for short) blockage during deepwater gas well production tests is very important in ensuring the test safety. In this paper, the distribution of wellbore temperature and pressure field under different test conditions was analyzed, and the changes of hydrate deposition and blockage degree in the pipe string in the whole process of test under different test systems were evaluated using the hydrate generation-deposition-decomposition calculation method. On this basis, a deepwater gas well production test method based on hydrate prevention and control was proposed. And the following research results were obtained. First, in the process of deepwater gas well tests, the vapor-liquid phase of annular-mist flow pattern with the greatest risk of hydrate blockage is often formed in the wellbore. Therefore, it is more reasonable to take measures to prevent hydrate blockage in the process of tests than to prevent the formation of hydrate. Second, when the conventional four-point test method is used, it is required to set low gas production measurement points with lower flowing temperature. In the wellbore with high temperature and low temperature, however, hydrate tends to form and deposit easily, and a long period of test will increase the risk of test string blockage. Third, the mixed-sequence test system suitable for deepwater gas well tests can change wellbore temperature by adjusting the sequence of measuring points without changing the production rate and duration, so as to decompose hydrate sediment layers and reduce the maximum blockage degree of test string in the process of tests. Fourth, a three-point or two-

point test method is recommended for deepwater gas wells without sand production, stress sensitivity, retrograde condensation and water production. Superior to the conventional four-point test method, three-point and two-point test methods can effectively reduce the risk of hydrate deposition and blockage in the test string, and it can shorten the test time and reduce the test cost on the premise of ensuring the accuracy of the productivity equation. In conclusion, the research results are of help to the field test construction of deepwater gas wells.

Number of references: 38

Main heading: Offshore gas well production

Controlled terms: Boreholes - Deposition - Flow patterns - Gas hydrates - Hydration - Low temperature production - Natural gas - Offshore gas wells - Oil field equipment - Temperature - Well testing

Uncontrolled terms: Flow assurance - Gas well - Prevention and controls - Production test - Productivity equation - Retrograde condensation - Stress sensitivity - Wellbore temperature

Classification code: 511.2 Oil Field Equipment - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 631.1 Fluid Flow, General - 641.1 Thermodynamics - 802.3 Chemical Operations

DOI: 10.3787/j.issn.1000-0976.2019.07.008

Database: Compendex

147.

Accession number: 20193207285057

Title: **An engineering scheme of improving shale gas development benefit in the Sichuan Basin**

Authors: Liu, Naizhen ; Gao, Yuanwen ; Wang, Tingrui ; Huang, Zhiqiang ; Gao, Wei ; Wang, Xigui ; Liu, Jinxia

Author affiliation: CNPC Greatwall Drilling Company, Beijing; 100101, China

Engineering Technology Research Institute, CNPC Greatwall Drilling Company, Panjin; Liaoning; 124010, China

Corresponding author: Huang, Zhiqiang (hzq.gwdc@cnpc.com.cn)

Source title: Natural Gas Industry

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Pages: 93-98

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The marine shale of Upper Ordovician Wufeng Fm to Lower Silurian Longmaxi Fm is the target layer of shale gas development in the south of the Sichuan Basin. The L11 sublayer of Longmaxi Fm is the "sweet spot" principal shale gas reservoir. The "non-essential" shale gas reservoir of L11-L12 above L11 sublayer cannot be stimulated sufficiently due to the restriction of the fracture propagation upward in horizontal wells, and its development is not cost effective by drilling new wells, so a great deal of resources (about two thirds of the total shale gas reserves) cannot be produced. In regard of this, an engineering scheme of "reasonable production casing cementing + casing cutting + efficient milling + conventional sidetrack drilling, completion and fracturing" was put forward. In addition, the feasibility of the key technologies and economy of the scheme were analyzed. And the following research results were obtained. First, determine the reasonable cementing length, together with the wellhead safety valve and downhole annular packoff to ensure that subsequent fracturing and production requirements are satisfied, and the to the cement of the production casing of a new well can be returned to an appropriate depth in the intermediate casing. Second, the mechanical casing cutting technology is mature, and compared with conventional milling technologies, its milling efficiency and service time of efficient milling are twice higher. Third, these low-cost efficient wellbore treatment and conventional sidetrack drilling & completion and fracturing technologies enable the scheme goal to be realized. Fourth, compared with the scheme of drilling new wells, this scheme can save the well construction cost by about 30%. The estimated daily testing production rate of "non-essential" shale gas reservoirs is 52 thousand m3 per well, and the accumulative production of 10 years is 49 million m, which means a good economic return. In conclusion, this scheme provides a new idea for the economic and efficient development of "non-essential" shale gas reservoirs, and it is conducive to the fast production increase and long-term stable production of shale gas in China.

Number of references: 18

Main heading: Horizontal wells

Controlled terms: Cementing (shafts) - Cost effectiveness - Fracture - Gases - Infill drilling - Milling (machining) - Oil well casings - Petroleum reservoirs - Proven reserves - Shale gas - Well drilling - Well testing - Wellheads

Uncontrolled terms: Conventional millings - Fracture propagation - Gas reservoir - Production casings - Production requirements - Shale gas reservoirs - Sichuan Basin - Silurian

Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 604.2 Machining Operations - 911.2 Industrial Economics - 951 Materials Science

Numerical data indexing: Age 1.00e+01yr, Percentage 3.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.05.011

Database: Compendex

148.

Accession number: 20194807752481

Title: **A multi-well evaluation method for carbonate karst reservoirs and its geological application**

Title of translation: **碳酸盐岩岩溶储层多井评价方法及地质应用**

Authors: Feng, Qingfu ; Jiang, Qingchun ; Ren, Mengyi ; Wang, Zecheng ; Liu, Yingming ; Tian, Han ; Huang, Shipeng

Author affiliation: PetroChina Research Institute of Petroleum Exploration & Development, Beijing; 100083, China

Source title: Natural Gas Industry

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Volume: 39

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Publication year: 2019

Pages: 39-47

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Multi-well evaluation is a technology for predicting a reservoir and the plane distribution laws of its oil/gas bearing property based on single-well fine interpretation, comparison and analysis, but the conventional logging data cannot be used to distinguish carbonate karst reservoirs, so it is quite important to determine how to clarify the plane distribution laws of karst development degree by using the multi-well evaluation results. In this paper, the karst development characteristics were analyzed reflected by the imaging logging calibrated based on core samples from 15 wells in the Gaoshiti-Moxi area of the Sichuan Basin. Then, the standard imaging chart for each karst development zone in the Middle Permian Maokou Formation was established, and the response characteristics of the conventional logging in each zone were analyzed by using cross-plot and histogram. Finally, on this basis, a new method for identifying karst development zones by using the electrical imaging logging to calibrate the conventional logging was developed. And the following research results were obtained. First, the karst zone of Maokou Formation in the Gaoshiti-Moxi area is divided into weathering crust residue, vertical seepage karst zone, horizontal underflow karst zone and weakly karstified basement from the top to the bottom. Second, in the imaging logging image, the weathering crust residue is displayed in a banded mode of "dark-bright-dark", the vertical seepage karst zone is in a combined mode of vertical line and dark phyre, the horizontal underflow karst zone is in a combined mode of horizontal line-layer and phyre, and the weakly karstified basement is in a mode of bright block, occasionally with linear or phyric characteristics. Third, the effective reservoirs are mainly developed in the vertical seepage zone and the top of horizontal underflow zone. Fourth, the development of Maokou Formation karst is mainly controlled by fracture development, which is in close relation with faults. In conclusion, this newly developed technology is generally applicable to the multi-well evaluation of carbonate karst reservoirs, and its interpretation results provide the key technical support for the deployment of Middle Permian wildcat wells in the Sichuan Basin.

Number of references: 14

Main heading: Petroleum reservoir evaluation

Controlled terms: Buildings - Carbonation - Horizontal wells - Landforms - Oil field development - Oil well logging - Oil wells - Seepage - Weathering - Wildcat wells

Uncontrolled terms: Carbonate rock - Gaoshiti-Moxi area - Imaging logging - Karst division - Multi wells - Seepage zones - Sichuan Basin - Underflows

Classification code: 402 Buildings and Towers - 481.1 Geology - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 802.2 Chemical Reactions

DOI: 10.3787/j.issn.1000-0976.2019.09.005

Database: Compendex

149.

Accession number: 20194807753442

Title: **A temperature-stress model for pipeline pre-cooling in an LNG receiving terminal**

Title of translation: **LNG接收站管道预冷温度-应力模型**

Authors: Chen, Feng ; Zhang, Chen ; Chen, Ruiying ; Liu, Yonghao ; Wang, Yaqun ; Wang, Xiuhua

Author affiliation: CNOOC Gas & Power Group, Beijing; 100028, China

Chongqing Division, PetroChina Southwest Oil & Gasfield Company, Chongqing; 400021, China

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 28

Main heading: Pipelines

Controlled terms: Calculations - Computational fluid dynamics - Control engineering - Cooling - Fatigue of materials - Liquefied natural gas - Natural gasoline plants - Thermal fatigue

Uncontrolled terms: Lng receiving terminals - Pre-cooling - Problem-free operations - Structural weakness - Temperature differences -

Temperature modeling - Temperature stress - Thermal stress effects

Classification code: 513.2 Petroleum Refineries - 523 Liquid Fuels - 619.1 Pipe, Piping and Pipelines - 641.2 Heat Transfer - 723.5 Computer Applications - 921 Mathematics - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.09.013

Database: Compendex

150.

Accession number: 20195107877700

Title: **Development trend of marine shale gas reservoir evaluation and a suitable comprehensive evaluation system**

Title of translation: **海相页岩气储层评价发展趋势与综合评价体系**

Authors: Jiang, Yuqiang ; Fu, Yonghong ; Xie, Jun ; Dong, Dazhong ; Zhou, Keming ; Cheng, Xiaoyan ; Qi, Lin ; Zhang, Haijie ; Chen, Chao ; Ma, Tinghu ; Gu, Yifan

Author affiliation: School of Geosciences and Technology, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Unconventional Reservoir Evaluation Laboratory, UOGKL, CNPC, Chengdu; Sichuan; 610500, China

PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

PetroChina Research Institute of Petroleum Exploration and Development, Langfang; Hebei; 065007, China

Sichuan Shale Gas Exploration and Development Co., Ltd., Chengdu; Sichuan; 610051, China

Geological Exploration and Development Research Institute, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

Chongqing Shale Gas Exploration and Development Co., Ltd., Chongqing; 610213, China

Source title: Natural Gas Industry

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Publication year: 2019

Pages: 1-9

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: At present, shale gas exploration and development in China is faced with some problems, such as the imperfect evaluation system of reservoir effectiveness and the limitations of reservoir evaluation system on efficient development of shale gas. In order to improve the content and the standard of reservoir evaluation, this paper analyzed the shortcomings and challenges in the static evaluation of shale gas reservoirs on the basis of existing reservoir evaluation, and established a method for evaluating shale gas reservoir effectiveness and a scheme for classifying pore systems. Then, the dynamic evaluation parameters after shale fracturing and their effects on drainage and production measures were discussed. In addition, the potential evaluation parameters of "automatic mitigating water blocking" were studied, and a comprehensive reservoir evaluation system of "static-dynamic" combination was established. And the following research results were obtained. First, new challenges to the shale gas reservoir evaluation are emerged as the lack of in-depth study on "reservoir effectiveness, dynamic evaluation parameter system after fracturing and drainage and production measures after fracturing", which leads to the serious lag of existing shale gas reservoir evaluation system behind production. Second, The evaluation of reservoir effectiveness is mainly presented as the evaluation on the lower limit of effective porosity, and is embodied in the influence of clay bound water and unconnected pores on the development of shale gas. Third, the development of shale gas reservoir evaluation follows the trend of refining the static reservoir evaluation parameters, defining the potential evaluation indexes of "automatic mitigating water blocking" and establishing the reservoir comprehensive evaluation system of "static-dynamic" combination. Fourth, a postfrac dynamic evaluation system is determined for the potential evaluation indexes of "automatic mitigating water blocking" (e.g. wettability, water imbibition retention capacity, water imbibition expansion mode, expansion rate, and water imbibition cracking capacity). Fifth, a reservoir evaluation idea is put forward that "static evaluation of shale gas reservoir is the foundation and postfrac dynamic evaluation is the complement", and a comprehensive reservoir evaluation system is established of "static-dynamic" combination suitable for the evaluation of marine shale gas reservoirs in China.

Number of 25

references:

Main heading: Petroleum reservoir evaluation

Controlled terms: Fracture - Gases - Geological surveys - Parameter estimation - Petroleum prospecting - Petroleum refining - Petroleum reservoirs - Shale gas

Uncontrolled terms: Comprehensive evaluation system - Development trends - Dynamic parameters - Evaluation parameters - Potential evaluation - Shale gas reservoirs - Static dynamics - Water-blocking

Classification code: 481.1 Geology - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 513.1 Petroleum Refining, General - 522 Gas Fuels - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.10.001

Database: Compendex

151.

Accession number: 20193607404743

Title: **Distribution rules, main controlling factors and exploration directions of giant gas fields in the Sichuan Basin**

Authors: Wei, Guoqi ; Yang, Wei ; Liu, Mancang ; Xie, Wuren ; Jin, Hui ; Wu, Saijun ; Su, Nan ; Shen, Juehong ; Hao, Cuiguo

Author affiliation: PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

Corresponding author: Yang, Wei (yangw69@petrochina.com.cn)

Source title: Natural Gas Industry

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Publication year: 2019

Pages: 1-12

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Over the past decade, great progresses have been made in

natural gas exploration in the Sichuan Basin, where several large gas fields (such as Anyue) have been discovered. With the increase of data and the deepening of exploration, new knowledges have been gained in geological theory, thus it is necessary to further analyze the distribution characteristics and main controlling factors of large gas fields, thus to put forward new exploration directions for large gas fields. Therefore, based on the statistics on the geological parameters of 20 large gas fields discovered in this basin, the distribution rules, formation conditions and main controlling factors of large gas fields were analyzed, and the follow-up exploration directions were proposed. The following results were achieved. (1) Large gas fields are developed in different tectonic regions in the Sichuan Basin, mostly in the low and gentle tectonic belts in the central Sichuan Basin. Large gas fields are developed in seven series of strata in longitudinal stratigraphic sequences, which are dominated by the reef-shoal large gas fields formed in the Upper Permian Changxing-Lower Triassic Feixianguan Fms. (2) There are four sets of source rocks contributing to the formation of large gas fields, mostly from the assemblage of Xujiahe Fm source rocks. (3) Reservoirs in the large gas fields are dominated by porous carbonates and tight sandstones; large gas fields are mostly structural-lithological ones and normal pressure ones. (4) The development of marine large gas fields are mainly controlled by intracratonic rifts and paleo-uplifts. The controlling effect of intracratonic rifts is mainly from three aspects, namely the hydrocarbon generation center of source rocks, high-energy facies belts on the platform edges, and lateral sealing for hydrocarbon accumulation. The controlling effect of the paleo-uplifts mainly acts from another three aspects: intra-platform high-energy facies belts, karstic dolomite reservoirs and long-term hydrocarbon accumulation. The structures of foreland basins controlled the development of the continental large gas fields from four aspects: tectonic setting, source and reservoir assemblage, trap type and fracture distribution. In conclusion, a total of 5 domains with 14 favorable zones are the follow-up exploration directions of large gas fields in the Sichuan Basin.

Number of references: 31

Main heading: Natural gas fields

Controlled terms: Gas industry - Gases - Hydrocarbons - Lithology - Petroleum prospecting - Stratigraphy - Tectonics

Uncontrolled terms: Distribution rule - Exploration direction - Foreland basin - Geological features - Intracratonic rift - Large gas field - Main controlling factors - Paleo-uplift - Sichuan Basin

Classification code: 481.1 Geology - 512.1.2 Petroleum Deposits : Development Operations - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 804.1 Organic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.06.001

Database: Compendex

152.

Accession number: 20193607404716

Title: **Geological characteristics and new understandings of exploration and development of Jurassic lacustrine shale oil and gas in the Sichuan Basin**

Authors: Yang, Yueming ; Huang, Dong

Author affiliation: PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

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Publication year: 2019

Pages: 22-33

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Oil and gas exploration has been successively developed in the lacustrine shale of the Da'anzhai Member of the Jurassic Ziliujin Fm in the Sichuan Basin by many companies at home and abroad such as PetroChina, Sinopec, Shell, etc. However, there are still doubts about why the proved reserves is out of proportion to the rich hydrocarbon resources and the oil and gas yield rates unmatched with the tight petrophysical properties of the reservoirs in this study area. In view of this, in combination with cores, outcrops, drilling, logging, oil test, geochemical analysis data, we made research on geological characteristics and exploration targets of shale oil & gas in this study area. The following findings were obtained. (1) Three sets of quality shale layers including the Dongyuemiao, Da'anzhai

members in the Ziliujing Fm, and the upper member of Lianggaoshan Fm, are featured by source-reservoir integration and tight connection, among which the Da'anzhai member is typical of well-developed shale reservoirs. (2) The Da'anzhai shale reservoir has such characteristics as high content of organic matters and brittle minerals, moderate thermal evolution degree, strong hydrocarbon generation capacity, good petrophysical behaviors, favorable storage property, good source-reservoir relationship, great thickness, good hydrocarbon-bearing property, and so on. (3) Many test data in detail from a successful well in the Da'anzhai member such as organic matter content, pyrolytic parameter, petrophysical properties, etc., demonstrated that oil and gas supply is quite enough for both shale and crustal limestone reservoirs there, and the former ones are so much stronger that the Da'anzhai is the main target of effective utilization of lacustrine shale oil and gas reserves in the Jurassic strata. (4) Based upon the current new understandings, technical measures for unconventional hydrocarbon resources like horizontal wells and volumetric fracturing, should be adopted to explore shale oil and gas resources in this study area, which will be hopefully succeeded. In conclusion, this paper provides a theoretic and technical support for new discoveries and effective utilization of reserves in this study area.

Number of references: 22

Main heading: Proven reserves

Controlled terms: Analytical geochemistry - Biogeochemistry - Digital storage - Energy resources - Gases - Horizontal wells - Hydrocarbons - Lime - Oil bearing formations - Oil well testing - Organic minerals - Petroleum reservoirs - Petrophysics

Uncontrolled terms: Exploration and development - Geological features - Jurassic - Lacustrine - Oil and gas - Sichuan Basin

Classification code: 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 525.1 Energy Resources and Renewable Energy Issues - 722.1 Data Storage, Equipment and Techniques - 801 Chemistry - 801.2 Biochemistry - 804.1 Organic Compounds - 804.2 Inorganic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.06.003

Database: Compendex

153.

Accession number: 20193207285119

Title: **A discussion on CBM development strategies in China based upon a case study of PetroChina Coalbed Methane Co., Ltd.**

Authors: Wen, Shengming ; Zhou, Ke ; Lu, Qian

Author affiliation: PetroChina Coalbed Methane Co., Ltd., Beijing; 100028, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Pages: 129-136

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 19

Main heading: Methane

Controlled terms: Coal bed methane - Coal deposits - Firedamp - Metamorphic rocks - Strategic planning

Uncontrolled terms: China - Development strategies - Exploration and development - Industrial base - Ordos Basin - PetroChina - Technical progress - Xinjiang regions

Classification code: 503 Mines and Mining, Coal - 522 Gas Fuels - 804.1 Organic Compounds - 912.2 Management

DOI: 10.3787/j.issn.1000-0976.2019.05.016

Database: Compendex

154.

Accession number: 20193907482172

Title: **Experiment and evaluation on the in-situ rapid preparation of marine non-diagenetic natural gas hydrate**

Title of translation: **海洋非成岩天然气水合物原位快速制备实验及评价**

Authors: Li, Haitao ; Zhao, Jinzhou ; Liu, Anqi ; Zhang, Liehui ; Wei, Na ; Wu, Kaisong ; Zhou, Shouwei ; Pei, Jun ; Zhang, Wenyi ; Yang,

Luyue ; Ji, Hui

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Geological Exploration and Development Institute, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

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Number of references: 17

Main heading: Gas hydrates

Controlled terms: Bubble formation - Density of gases - Electric conductivity - Hydration - Natural gas - Natural gas deposits

Uncontrolled terms: Bubbling method - Diagenetics - Inducing period - Preparation kettle - Rapid preparation - Stirring method - Three-in-One method

Classification code: 512.2 Natural Gas Deposits - 522 Gas Fuels - 631.1.2 Gas Dynamics - 701.1 Electricity: Basic Concepts and Phenomena - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Size 3.00e+02m to 3.00e+03m, Volume 1.06e+00m3

DOI: 10.3787/j.issn.1000-0976.2019.07.020

Database: Compendex

155.

Accession number: 20192607106206

Title: **A calculation method for brittleness index of shale gas**

reservoirs based on the imaging spectroscopy mineral maps: A case study of the Lower Silurian Longmaxi shale gas reservoir in the southern Sichuan Basin

Title of translation: **基于成像矿物谱的页岩气储层脆性指数计算方法-以四川盆地南部下志留统龙马溪组为例**

Authors: Yan, Lei ; He, Chuanliang ; Hou, Kejun

Author affiliation: College of Energy, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

Sinopec Southwest Oilfield Service Corporation, Chengdu; Sichuan; 610000, China

Corresponding author: He, Chuanliang (hecliang@163.com)

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Abbreviated source title: Natur. Gas Ind.

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The brittleness index of shale gas reservoirs is one of the key parameters for the fracturing scheme design. At present, however, the current method to calculate the brittleness index is expensive, time and labor consuming, and overly dependent on coring data. In view of this, the Lower Silurian Longmaxi shale gas reservoir in the southern Sichuan Basin was taken as the research object in this paper. Firstly, the imaging log data of this area was analyzed and corrected, the images were enhanced in the form of histogram and the imaging log image was calibrated as the imaging spectroscopy mineral map. Then, based on the theory of normal distribution, combined with experimental analysis data, the mineral content of shale gas reservoirs was estimated by analyzing the mineral map. Finally, based on fracture characteristics, the calculation model for brittleness index was established. In this way, a new method for calculating mineral content and brittleness index was developed and has been verified in many shale gas wells in this area. And the following research results were obtained. First, this new method

has the advantages of low cost, strong applicability, high calculation accuracy and practical value. Second, compared with the brittleness index calculation methods that are currently used, the data obtained by the new method are universal and its brittleness index calculation results are continuous. Third, this new method can accurately reflect the effects of bedding, thin layer and local lithology change on the brittleness index, playing an important role in evaluating the brittleness and fracturing performance of shale gas reservoirs. Fourth, field application reveals that the calculation results of this new method are in a better accordance with the actual drilling results. Industrial productivity of sh ale gas is achieved in many wells of this area during the testi ng. In conclusion, this new method provides a technical support for fracturing opt imization and evaluation of marine shale gas reservoirs.

Number of references: 22

Main heading: Petroleum reservoirs

Controlled terms: Brittleness - Fracture - Fracture mechanics - Gases - Image enhancement - Lithology - Marine engineering - Mineral exploration - Minerals - Normal distribution - Petroleum reservoir evaluation - Plasticity - Productivity - Reservoirs (water) - Shale gas

Uncontrolled terms: Brittleness index - Calculation models - Evaluation and fracturing performance - Mineral spectra - Sichuan Basin - Silurian

Classification code: 441.2 Reservoirs - 481.1 Geology - 482.2 Minerals - 501.1 Exploration and Prospecting Methods - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 675 Marine Engineering - 922.1 Probability Theory - 931.1 Mechanics - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.02.007

Database: Compendex

156.

Accession number: 20192607106205

Title: **Characteristics of Permian volcanism in the western Sichuan Basin and its natural gas exploration potential**

Title of translation: **四川盆地西部二叠系火山作用特征与天然气勘探潜力**

Authors: Lu, Jianlin ; Zuo, Zongxin ; Shi, Zheng ; Dong, Xia ; Wu, Qingjie ; Song, Xiaobo

Author affiliation: Wuxi Research Institute of Petroleum Geology, Sinopec

Petroleum Exploration & Production Research Institute, Wuxi; Jiangsu; 214126, China

Exploration and Development Research Institute, Sinopec Southwest Petroleum Company, Chengdu; Sichuan; 610041, China

Corresponding author: Zuo, Zongxin (zzx86@foxmail.com)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: It was previously deemed that volcanic rocks in the western Sichuan Basin were not developed, which restricted the exploration of volcanic gas reservoirs in this area. Recently, however, Sinopec's wildcat well, Well YS1 encounters Upper Permian volcanic rocks about 300 m thick in the western Sichuan Basin, the reservoir physical properties of which are good with strong gas shows. In order to evaluate the exploration prospect of volcanic gas reservoirs in western Sichuan Basin, we studied the Permian volcanic rocks in this area from the aspects of formation and development characteristics, reservoir characteristics, gas genesis and plays based on the new understandings on exploration wells, combined with the analysis on tectonic evolution and its controlling effect on volcanism. Then, the volcanic eruption mechanism, the distribution mode of volcanic edifice and the hydrocarbon accumulation pattern of volcanic gas reservoir were figured out. Finally, the exploration potential of natural gas was evaluated. And the following research results were obtained. First, the Permian volcanic rocks in western Sichuan Basin are developed and its tectonic setting is consistent with that of Emeishan basalt, which is the product of the Emeishan mantle plume. Second, under the control of vertical faults, a great number of volcanic edifices are developed and there are many eruption cycles. Volcanic rocks are superimposed vertically and connected laterally. Third, the volcanic rocks in western Sichuan Basin are different to some

extent from those in southwestern Sichuan Basin in terms of lithology, lithofacies and reservoir characteristics. In the western Sichuan Basin, the tuff of explosive facies is dominant with some basalt of effusive facies, and the reservoir space of volcanic rocks is mainly acted by inter-breccia skeleton pores, dissolved pores and matrix micro-pores. In conclusion, multiple sets of effective source rocks are developed around the volcanic intervals in western Sichuan Basin, and together they constitute effective natural gas plays. Therefore, it has a better natural gas exploration prospect, an d it is a new field worthy of attention.

Number of references: 27

Main heading: Wildcat wells

Controlled terms: Basalt - Buildings - Gases - Geological surveys - Lithology - Natural gas - Natural gas fields - Petroleum prospecting - Petroleum reservoirs - Tectonics - Volcanic rocks - Volcanoes

Uncontrolled terms: Emeishan basalts - Exploration potential - Permian - Volcanic reservoirs - Volcanism - Western Sichuan basin

Classification code: 402 Buildings and Towers - 481.1 Geology - 482.2 Minerals - 484 Seismology - 512 Petroleum and Related Deposits - 522 Gas Fuels

Numerical data indexing: Size 3.00e+02m

DOI: 10.3787/j.issn.1000-0976.2019.02.006

Database: Compendex

157.

Accession number: 20192607106204

Title: **Logging based lithology identification of Permian mafic volcanic rocks in the Sichuan Basin: A case study from the Well Yongtan 1**

Title of translation: **四川盆地二叠系基性火山岩测井评价技术-以永探1井区火山岩为例**

Authors: Wu, Yuyu ; Xie, Bing ; Wu, Lihong ; Lai, Qiang ; Zhao, Rongrong

Author affiliation: Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to determine the lithology of Permian volcanic rocks in the western Sichuan Basin quickly, accurately and efficiently, a series of studies were carried out from the aspects of volcanic lithology identification, reservoir parameter modeling and fluid property discrimination by using core, thin section, conventional logging, elemental scanning logging and image logging data comprehensively. And the following research results were obtained. (1) The Well Yongtan 1 is mainly dominated by basic volcanic rocks with low radioactivity and its lithology can be divided to basalt, breccia-bearing tuff lava and breccia lava according to core analysis and well logging. (2) The Well Yongtan 1 can be divided into three secondary eruptive cycles. The lithology of gas-bearing tested is mainly breccia tufa lava, so as to the key point of volcanic rock further exploration in the Sichuan Basin. (3) The Well Yongtan 1 is characterized by high porosity and low permeability. The porosity calculated by the method of variable density skeleton and variable acoustic time intersection agrees well with the core porosity. (4) Affected by many factors, the volcanic fluids are difficult to identify by only use of the resistivity method so that the macroscopic capture cross section of thermal neutron and Poisson's ratio method are applied effectively in fluid property identification in the Well Yongtan 1. (5) It is an important guarantee for volcanic rock exploration and geological understanding to popularize the application of new logging technology and obtain all accurate logging data in this basin.

Number of references: 20

Main heading: Volcanic rocks

Controlled terms: Image processing - Lithology - Oil bearing formations - Petroleum prospecting - Porosity - Radioactivity logging - Volcanoes

Uncontrolled terms: Capture cross sections - Conventional logging - Lithology identification - Permian - Reservoir parameters - Resistivity methods - Volcanic lithology - Western Sichuan basin

Classification code: 481.1 Geology - 481.4 Geophysical Prospecting - 482.2 Minerals - 484 Seismology - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 931.2 Physical Properties of Gases, Liquids and Solids

DOI: 10.3787/j.issn.1000-0976.2019.02.005

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158.

Accession number: 20192607106210

Title: **Calculation and analysis of drilling fluid flow resistance in coiled tubing for slimhole drilling based on the Herschel-Buckley Model**

Title of translation: **基于赫-巴模型的微小井眼钻井连续油管内钻井液流阻计算分析**

Authors: Hou, Xuejun ; Jin, Rui ; Song, Hongqi ; Zhang, Hui ; Wang, Zhengku ; Gao, Peng ; Fang, Jun

Author affiliation: College of Petroleum Engineering, Chongqing University of Science and Technology, Chongqing; 430061, China

MOE Key Laboratory of Petroleum Engineering, China University of Petroleum, Beijing; 102249, China

Chuandong Drilling Company, CNPC Chuanqing Drilling Engineering Co., Ltd., Chongqing; 400021, China

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The coiled tubing (CT) drilling technology in slim holes with

many advantages has been unfortunately restricted due to tight space for fluids flowing, small flow rates, high flowback rates, huge loss in circulation. In order to solve the problem of overly large fluids flow resistance in the CT drilling, we calculated the flow resistance of drilling fluid in CT based upon the Herschel-Buckley Model and the features of this technology, and discussed the relationships between the fluids flow resistance and the other factors such as average flow rates of fluids, CT length (or well depth), CT water-hole diameter, tubing roller diameter, etc. The following findings were achieved. (1) On the tubing roller, CT internal flow resistance increases linearly with the drilling fluids flow rate and drilling fluids with small flow rates will decrease the flow resistance on the roller. (2) Both on the tubing roller and in the wellbore, CT drilling fluid flow resistance increases linearly with CT length but decreases linearly with CT internal water-hole diameter; therefore, large-diameter CTs will be better for drilling deep wells. (3) The tubing roller diameter has little effect on the CT fluids flow resistance, which increases with the fluids flow rate linearly; The CT wound on the roller is long enough to use multiple rollers so as to reduce the flow resistance of fluids in CT. In conclusion, this study provides a reference for controlling and reducing the CT fluids flow resistance and optimizing the relevant parameters, helpful to accelerate the popularization and applic ation of this technology.

Number of references: 27

Main heading: Coiled tubing

Controlled terms: Boreholes - Drilling fluids - Flow rate - Infill drilling - Oil field equipment - Rollers (machine components)

Uncontrolled terms: Buckley models - Fluid flow resistance - Hole diameter - Slim hole - Wellbore

Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 601.2 Machine Components - 619.1 Pipe, Piping and Pipelines - 631 Fluid Flow

DOI: 10.3787/j.issn.1000-0976.2019.02.011

Database: Compendex

159.

Accession number: 20194807752486

Title: **Reunderstanding and significance of high-quality reservoirs of the inner Dengying Formation in the Anyue Gas Field**

Title of translation: **安岳气田灯影组内幕优质储层的重新认识及其意义**

Authors: Dai, Xiaofeng ; Du, Benqiang ; Zhang, Ming ; Li, Jun ; Tang, Tingke ; Xu, Youping ; Gan, Lideng ; Sun, Xiping

Author affiliation: PetroChina Research Institute of Petroleum Exploration & Development, Beijing; 100083, China

Shunan Division, PetroChina Southwest Oil & Gasfield Company, Luzhou; Sichuan; 646000, China

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ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The overall development of the top of the gas reservoir of the Dengying Formation, Upper Sinian in the Anyue Gas Field of the Sichuan Basin, has been deployed, and the inner Dengying Formation is the next potential succession layer. However, the high-quality reservoirs of inner Dengying Formation are undeveloped and cannot be identified on the seismic sections, which restricts its deepened understanding, exploration and development. In this paper, the logging and seismic response characteristics of high-quality reservoirs were analyzed using the mud logging and well logging data of the Anyue Gas Field, and a seismic response model for high-quality reservoir was established by means of seismic forward modeling. Then, the target processing was carried out for the problem of weak effective signals. Finally, the plane distribution of high-quality reservoirs of inner Dengying Formation and the favorable exploration areas were predicted. And the following research results were obtained. First, there are two types of high-quality reservoirs inside the Dengying Formation, i.e., concentrated vug type and independent cave type. Vertically, the independent cave reservoirs are mainly distributed within 100 m above the mudstone floor of the third Member of Dengying Formation. Horizontally, karst zones are developed along the bed. Laterally, they are scattered and beaded. And the scale is small. Second, seismic response of high-quality reservoirs inside the carbonate rocks is characterized by single-peak concealed "beaded" reflection, whose peak energy is relatively weak and can be

easily covered by the noise of seismic data. Third, deep-seated weak signal recovery and processing technology can be used to deal with the weak seismic response of high-quality cave reservoirs, improve the amplitude preservation and S/N ratio of seismic data, and obtain the beaded reflections on seismic sections so as to realize effective identification of high-quality cave reservoirs. In conclusion, the deep-seated weak signal recovery and processing technology is proved to be operable because the achieved results conform to the drilling data and the seismic forward modeling conclusions. In addition, high-quality cave reservoirs are developed at the bottom of the fourth Member of Dengying Formation, and they are locally distributed in a large scale. Therefore, it's one of the favorable succession layers for the following natural gas exploration and development of the Anyue Gas Field.

Number of references: 19

Main heading: Natural gas fields

Controlled terms: Caves - Gas industry - Gases - Geophysical prospecting - Mud logging - Petroleum prospecting - Petroleum reservoirs - Recovery - Sedimentary rocks - Seismic response - Seismic waves - Signal reconstruction

Uncontrolled terms: Dengying formation - Gas fields - High quality reservoir - Late Sinian - Multiple waves - Sichuan Basin - Succession layer series - Weak signals

Classification code: 481.1 Geology - 481.4 Geophysical Prospecting - 482.2 Minerals - 484 Seismology - 484.2 Secondary Earthquake Effects - 512 Petroleum and Related Deposits - 522 Gas Fuels - 716.1 Information Theory and Signal Processing

Numerical data indexing: Size 1.00e+02m

DOI: 10.3787/j.issn.1000-0976.2019.09.002

Database: Compendex

160.

Accession number: 20192607089033

Title: **Characteristics and reservoir body classification & evaluation of Sinian Dengying karst reservoirs in the Gaoshiti Block of central Sichuan Basin**

Title of translation: **川中高石梯区块震旦系灯影组岩溶储层特征与储渗体分类评价**

Authors: Zhu, Xun ; Gu, Yifan ; Jiang, Yuqiang ; Tang, Tingke ; Xu, Wei ; Li, Kaihong ; Deng, Hui

Author affiliation: Exploration and Development Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

School of Geoscience and Technology, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Shunan Division, PetroChina Southwest Oil & Gasfield Company, Luzhou; Sichuan; 646000, China

Corresponding author: Jiang, Yuqiang (xnsyjyq3055@126.com)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The gas reservoir of the 4 Member of Sinian Dengying Fm (hereinafter referred to as Deng 4 Member) in central Sichuan Basin is a large gas field formed by the superposition of multiple factors which mainly consist of mound-shoal complex sedimentation and epigenetic karstification. And the existing industrial standards are limited in characterizing the features of the karst reservoirs in this area. In this paper, the karst reservoirs of Deng 4 Member in the Gaoshiti Block of central Sichuan Basin were classified based on its core observation, conventional-image logging, combined CT scanning and thin section analysis results, as well as the matching relationship of reservoir space. Then, based on three-dimensional seismic data and with the fine characterization of karst reservoir types as a constraint,the distribution of the mound-shoal complex, the development and distribution of fractures and pores, the distribution of high-quality reservoirs and the reserve abundance of high-quality reservoirs were analyzed by means of well-seismic combination. Finally, combined with actual production results, the classification criterion for the Dengying Fm karst reservoir bodies was established, and reservoir body classification and division study was carried out so as to define the dynamic & static characteristics of all types of reservoir bodies and select

the target reservoir bodies with favorable development conditions. And the following research results were obtained. First, the karst reservoirs of Deng 4 Member in the study area are divided into three types, i.e., pore type, pore-vuggy type and fracture-vuggy type, and the latter two types are high-quality reservoirs of Dengying Fm, with good physical property, exploitation effect and testing results. Second, the classification criterion of karst reservoir body is established, and according to this criterion, the karst reservoir bodies in the study area are divided into three types. Type I and II have a stable production capacity and good production effect, and can realize beneficial development. Third, there are 7 type I reservoir bodies, 10 type II reservoir bodies and 15 type III reservoir bodies. The dynamic gas reserves of type I and II reservoir bodies range from 2.169 to 3.708 billion m. It is concluded that type I and II reservoir bodies are characterized by good fracture-vuggy matching relationship, large thickness of high-quality reservoirs, high reserve abundance and good production effect, and they can be taken as favorable development targets of natural gas.

Number of references: 21

Main heading: Petroleum reservoir evaluation

Controlled terms: Computerized tomography - Fracture - Fracture testing - Gas industry - Landforms - Petroleum reservoirs - Proven reserves - Seismic prospecting - Seismology

Uncontrolled terms: Central Sichuan Basin - Classification criterion - Development targets - Karst reservoirs - Sinian

Classification code: 481.1 Geology - 484.1 Earthquake Measurements and Analysis - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 723.5 Computer Applications - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.03.005

Database: Compendex

161.

Accession number: 20192206992463

Title: **A magnetic torque optimization method for a hydraulic-magnetic coupling-drive cuttings cleaning tool**

Title of translation: **液力-磁耦合传动岩屑清洁装置的磁扭矩数值优化**

Authors: Sun, Xiaofeng ; Hu, Qiaobo ; Yan, Lipeng ; Chen, Ye ; Zhang, Kebo ; Qu, Jingyu

Author affiliation: School of Petroleum Engineering, Northeast Petroleum

University, Daqing; Heilongjiang; 163318, China

Sinopec Petroleum Engineering Research Institute, Beijing; 100101, China

Corresponding author: Hu, Qiaobo (1358941665@qq.com)

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Publisher: Natural Gas Industry Journal Agency

Abstract: In the process of well drilling, cuttings carrying is difficult in the horizontal section, and cuttings beds tend to form easily. In view of this, a hydraulic-magnetic coupling-drive cuttings cleaning tool is newly developed, but its magnetic torque transmission mechanism, optimum magnetic circuit structure and magnet layout are rarely researched. In this paper, the influence laws of magnetic circuit structure and permanent magnet dimension on the magnetic torque were analyzed by using finite-element numerical simulation method. And the following research results were obtained on the basis of numerical simulation and experimental study. First, the transmission efficiency of magnetic torque can be enhanced by increasing the magnetic flux density in the air gap, decreasing the magnetic circuit reluctance or increasing the magnetostatic energy. Second, the magnetic torque increases first and then decreases as the number of polepair increases. And it reaches the maximum value when the number of pole-pair is 12. Third, based on the coupling of the magnet volume under two constraints, i.e., the coverage area of permanent magnet on the tool's effective cross section and the magnet thickness, the thickness of permanent magnet is 8.4 mm. And the magnetic torque on the unit volume of magnet reaches the maximum value when the coverage area of permanent magnet on the tool's effective cross section is 71%. Fourth, the absolute error between the experimental result and the numerical simulation result is less than 17%. It is indicated that the numerical simulation model can satisfy the required engineering calculation accuracy. In conclusion, the numerical

simulation model established in this paper is rational and can be used as a technical method for optimizing the structure of this newly-developed tool.

Number of references: 18

Main heading: Magnetic circuits

Controlled terms: Cleaning - Cutting - Horizontal drilling - Horizontal wells - Hydraulic drives - Image resolution - Infill drilling - Magnetic couplings - Magnetic flux - Numerical methods - Numerical models - Permanent magnets - Structural optimization - Torque - Transmissions - Well drilling

Uncontrolled terms: Cleaning tools - Effective cross sections - Engineering calculation - Finite element numerical simulation - Magnetic circuit structures - Magnetic torques - Numerical optimizations - Transmission efficiency

Classification code: 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 602 Mechanical Drives and Transmissions - 701.2 Magnetism: Basic Concepts and Phenomena - 704.1 Electric Components - 802.3 Chemical Operations - 921 Mathematics - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Percentage 1.70e+01%, Percentage 7.10e+01%, Size 8.40e-03m

DOI: 10.3787/j.issn.1000-0976.2019.01.011

Database: Compendex

162.

Accession number: 20192607106213

Title: **Efficiency improvement, consumption reduction and optimization of high-sulfur natural gas sweetening units**

Title of translation: **高含硫天然气脱酸气装置提效降耗优化**

Authors: Shang, Jianfeng ; Qiu, Min ; Ji, Zhongli

Author affiliation: Puguang Branch, Sinopec Zhongyuan Oilfield Company, Puyang; Henan; 457061, China

College of Mechanical and Transportation Engineering, China University of Petroleum, Beijing; 102249, China

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Abstract: To increase purified gas production and reduce the comprehensive energy consumption of high-sulfur natural gas sweetening units, we established a process simulation model using the ProMax, based on the field operation data of a gas sweetening unit in the Sinopec Puguang Natural Gas Purification Plant. Then, sensitivity analysis and optimization study were carried out on the main operating parameters, including circulation rates, the concentrations and the inlet temperatures of primary and secondary absorption towers of MDEA (methyldiethanolamine) solutions. Finally, the effects of feed gas load reduction and pressure reduction and H2S content increase on the quality and yield rates of purified gas were analyzed under the optimized operating conditions, combined with the actual field situations. And the following research results were obtained. First, the absorption selectivity of MDEA solutions can be improved by decreasing the circulation rates, concentrations and inlet temperatures of MDEA solutions, which is favorable for the increase of the yield rates of purified gas. Specifically, the circulation rate of MDEA solution is the main factor influencing the comprehensive energy consumption of a high-sulfur natural gas sweetening unit. Second, when the flow rate, pressure and H2S content of feed gas fluctuate, the purification requirements can be satisfied under the optimized operating conditions. Third, energy conservation under low flow rates of feed gas can be achieved by reducing the flow rates of regenerated steam and adjusting the position of MDEA solutions entering the secondary absorption tower. Fourth, as H2S content is increased by 1%, it is necessary to increase the circulation rate of MDEA solution by about 20×10 kg/h. Fifth, after parameter optimization, the yield rate of purified gas is increased by 0.5% and the comprehensive energy consumption is reduced by 19.1% under the operating condition of full load.

Number of references: 21

Main heading: Natural gas fields

Controlled terms: Air purification - Energy utilization - Gas absorption - Gas

industry - Gases - Natural gas - Natural gasoline plants - Sensitivity analysis - Sulfur - Thermoanalysis

Uncontrolled terms: Gas sweetenings - High sulfur natural gas - Parameter optimization - Purified gas - Steady-state simulations - Thermo dynamic analysis

Classification code: 512.2.1 Natural Gas Fields - 513.2 Petroleum Refineries - 522 Gas Fuels - 525.3 Energy Utilization - 643 Space Heating, Ventilation and Air Conditioning - 801 Chemistry - 802.3 Chemical Operations - 804 Chemical Products Generally - 921 Mathematics

Numerical data indexing: Percentage 1.00e+00%, Percentage 1.91e+01%, Percentage 5.00e-01%

DOI: 10.3787/j.issn.1000-0976.2019.02.014

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163.

Accession number: 20195107877695

Title: **Production laws of shale-gas horizontal wells**

Title of translation: **页岩气水平井生产规律**

Authors: Guo, Jianlin ; Jia, Ailin ; Jia, Chengye ; Liu, Cheng ; Qi, Yadong ; Wei, Yunsheng ; Zhao, Shengxian ; Wang, Junlei ; Yuan, He

Author affiliation: PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

PetroChina Zhejiang Oilfield Company, Hangzhou; Zhejiang; 310023, China

PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Corresponding author: Jia, Chengye (cyjia@petrochina.com.cn)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: With the gradual advancement of shale gas development and the continuous increase of development scale in China, analyzing the production data of gas wells appropriately and evaluating the production laws of in-service wells provides the basis and guarantee for the evaluation of interim development effects and the formulation of next development schemes. In this paper, the production data of the shale gas horizontal wells in six shale gas development blocks of North America and China's national shale gas demonstration areas (including Changning-Weiyuan Block and Zhaotong Block) were analyzed, and the normalized production decline curves were established for different blocks by virtue of the hyperbolic-exponential hybrid decline model. Then, the variation trends of initial production and decline rates of shale gas wells were discussed. Finally, a fast evaluation method for the estimated ultimate reserve (EUR) of shale gas horizontal well was developed. And the following research results were obtained. First, in the early stage of development, the average initial production of shale gas horizontal wells presents an increasing trend year after year, but the distribution of the initial production is different. Then, the average initial production of gas wells varies in a platform-like mode. And in the later stage, a trend of decline year after year occurs. Second, the hyperbolic-exponential hybrid decline model is better applicable to the production decline analysis of shale gas horizontal wells in China and North America. The gas wells put into production in different years in the same block are similar in production decline laws. Third, the production decrement of the Changning Block in the first three years is 55%, 38% and 33% respectively, which are close to that of Fayetteville Block in North America. Whereas, the production decrement of Weiyuan Block in the initial stage of production is 63%, 46% and 37% respectively, which are much higher than that of the 5 blocks in the North America. Fourth, the EUR of gas wells is positively correlated with the cumulative production of the first year (Q1), and it is generally 2-5 times the Q1. As for the [Formula is presented] of gas wells, the Woodford Block is the highest, the Changning Block is equivalent to Barnett, Eagle Ford, Fayetteville and Haynesville Blocks, and the Weiyuan Block is relatively lower.

Number of references: 16

Main heading: Horizontal wells

Controlled terms: Gases - Natural gas well production - Natural gas wells - Petroleum reservoir evaluation - Proven reserves - Shale gas

Uncontrolled terms: Cumulative production - Decline modeling - Development effect - National shale gas demonstration area in China - North America - Production decline analysis - Production declines - Research results

Classification code: 512 Petroleum and Related Deposits - 522 Gas Fuels

Numerical data indexing: Percentage 3.30e+01%, Percentage 3.70e+01%, Percentage 3.80e+01%, Percentage 4.60e+01%, Percentage 5.50e+01%, Percentage 6.30e+01%

DOI: 10.3787/j.issn.1000-0976.2019.10.006

Database: Compendex

164.

Accession number: 20200408064904

Title: **The formation mechanisms of ultra-tight and overpressured gas reservoir in the third Member of Upper Triassic Xujiahe Formation in the northwestern Sichuan Basin**

Title of translation: **四川盆地西北部上三叠统须三段储层超致密与气藏超压成因**

Authors: Wang, Xueke ; Li, Wei ; Zhang, Benjian ; Pei, Senqi ; Chen, Zhuxin

Author affiliation: PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

Northwest Sichuan Division, PetroChina Southwest Oil & Gasfield Company, Jiangyou; Sichuan; 621741, China

Corresponding author: Li, Wei (lwe@petrochina.com.cn)

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: More studies have been carried out on the tight and overpressured gas reservoir of the Upper Triassic Xujiahe Formation in the northwestern Sichuan Basin, but the formation mechanisms of tight reservoir, the distribution characteristics and formation mechanisms of abnormal ultra-high pressure and the effects of thermal evolution on large-scale tight gas accumulation have not been researched systematically and thoroughly. To this end, this paper studied the reservoir characteristics and main controlling factors of the third Member of Xujiahe Formation (Xu 3 Member for short) in this area using a large quantity of drilling data obtained recently. And combined with the thermal evolution of the source rocks and the evolution of diagenesis, the reasons for the formation of tight reservoir were analyzed. Then, the formation mechanisms of overpressured gas reservoirs were studied based on tectonic movement after the temperature and pressure characteristics of the fluids in gas reservoirs were analyzed. Finally, the mechanisms of large-scale overpressured natural gas accumulation were analyzed after the characteristics of large-scale overpressured gas reservoirs were summarized. And the following research results were obtained. First, ultra-tight reservoir of Xu 3 Member is the product under the joint effect of strong diagenetic compaction and strong calcareous cementation caused by a large amount of carbonate debris in sediments. Second, the Xu 3 Member reservoir has experienced high thermal evolution in great burial depth. The tightest reservoir is the area with the highest thermal evolution and also the main tight gas development area. The formation of ultra-high pressure tight gas reservoir is obviously affected by the strong diagenesis and the high thermal evolution in the late Cretaceous period. Third, in Jian'ge area, the diagenetic compaction of Xu 3 Member sandstone/glutenite leads to the reduction of porosity by 20%. The important reason for the reservoir densification caused by carbonate cementation is that Anxian tectonic movement leads to the uplifting of Longmenshan Mountain, providing sufficient sources of carbonate rocks for the deposit of Xujiahe Formation. And consequently, the porosity is reduced by 10-20%. Fourth, the formation of abnormal high pressure gas reservoir in the depression zone of this area is not caused by structural compression, but by poor pressure release resulted from fracture underdevelopment, hydrocarbon generation pressurization and tectonic reversal, which leads to the formation of an ultra-high pressure development zone of ultra-tight reservoir. The fracture development in the front margin of Longmenshan and Micangshan fault belts leads to pressure release, so it is a normal pressure zone, whose reservoir physical properties are better than those of the depression zone. It is concluded that the formation mechanisms of large-scale ultra-high pressure tight gas reservoirs in this area are complex with

various influencing factors, and the close source-reservoir assemblage relationship, the high thermal evolution and hydrocarbon generation pressurization in the late Cretaceous, the tectonic reversal and stratigraphic uplift and erosion in the Himalayan period, the poor pressure release of ultra-tight reservoir caused by the excellent sealing ability of surrounding rock play a significant role in the large-scale accumulation of abnormal ultra-high pressure natural gas in this area.

Number of references: 39

Main heading: High pressure effects

Controlled terms: Carbonation - Cementing (shafts) - Compaction - Gases - Hydrocarbons - Natural gas - Petroleum reservoirs - Porosity - Pressurization - Sedimentology - Stratigraphy - Tectonics - Tight gas

Uncontrolled terms: Abnormal high pressure - Hydrocarbon generation - Natural-gas accumulation - Sichuan Basin - Tigh treservoirs - Upper Triassic

Classification code: 481.1 Geology - 512.1.1 Oil Fields - 522 Gas Fuels - 802.2 Chemical Reactions - 804.1 Organic Compounds - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Percentage 1.00e+01% to 2.00e+01%, Percentage 2.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.11.004

Database: Compendex

165.

Accession number: 20194207561317

Title: **Hydrocarbon accumulation patterns of salt crust covered biogenic gas reservoirs in the Sanhu Depression, Qaidam Basin**

Title of translation: **柴达木盆地三湖坳陷盐壳遮挡型生物气成藏模式**

Authors: Shan, Junfeng ; Ju, Juncheng ; Zhang, Wenwei ; Han, Hongwei ; Zhou, Tiesuo ; Wang, Yusi ; Yang, Shijie ; Cao, Yusen

Author affiliation: Exploration and Development Research Institute, PetroChina Liaohe Oilfield Company, Panjin; Liaoning; 124010, China

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Publication year: 2019
Pages: 25-32
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency

Abstract: Quaternary biogenic gas reservoirs are extensively developed in the Sanhu Depression of the Qaidam Basin, where the largest domestic biogenic gas production base has been built up. In recent years, however, the exploration of biogenic gas there encounters a variety of difficulties, such as the identification of true and false seismic abnormality, the determination of micro-relief structure and the identification and description of lithologic traps, which are the bottlenecks restricting its exploration breakthrough. In this paper, hydrocarbon accumulation patterns of biogenic gas were studied. Then, based on fine structure interpretation results, combined with laboratory experiments, the sealing ability, distribution range, formation time and genesis of salt crust were discussed, and the salt crust covered hydrocarbon accumulation pattern of biogenic gas was put forward. Finally, combined with the conditions of source rocks and reservoirs, the exploration prospect of salt crust covered biogenic gas reservoirs was predicted. And the following research results were obtained. First, the Quaternary in the Sanhu Depression is composed of sandstone-mudstone interbeds of shore-shallow lake facies, with superior conditions of source rocks and reservoirs. Many source-reservoir-caprock assemblages are vertically formed. The biogenic gas has the characteristics of dynamic hydrocarbon accumulation, i.e., continuous migration, accumulation, diffusion and re-accumulation. Second, under the effect of Himalayan movement, the climate changes frequently and the salinity of the ancient lake is zoned in the Sanhu Depression. A freshwater area is formed at the inlet of the river in the south and a brine area is formed in the north. Under the influence of evaporation, the phreatic water in the north is salinized continuously, and a set of extensively distributed salt crust with steady thickness and a strong sealing ability is formed at the eastern part of Lingjian fault. Third, the biogenic gas generated by dark mudstone of lacustrine facies in the depression center migrates laterally and vertically to Lingjian fault zone and gets accumulated under the sealing of salt crust. In conclusion, high-quality source rocks and reservoirs and the salt crust with a strong sealing ability in the Sanhu Depression constitute a good spatial-temporal

configuration relationship of source rocks, reservoirs and cap rocks, so salt crust covered biogenic gas reservoirs can be formed to provide abundant natural gas resources with a broad exploration prospect.

Number of references: 20

Main heading: Petroleum prospecting

Controlled terms: Climate change - Energy resources - Gases - Hydrocarbons - Lakes - Natural gas - Natural gas deposits - Petroleum reservoirs - Sedimentary rocks

Uncontrolled terms: Biogenic gas - Exploration potential - Hydrocarbon accumulation - Qaidam basin - Quaternary - Reservoir-caprock assemblage - Salt crust - Sanhu Depression

Classification code: 443.1 Atmospheric Properties - 482.2 Minerals - 512 Petroleum and Related Deposits - 522 Gas Fuels - 525.1 Energy Resources and Renewable Energy Issues - 804.1 Organic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.08.003

Database: Compendex

166.

Accession number: 20193907482156

Title: **Strain evolution characteristics of X80 line pipes with plain dents**

Title of translation: **X80管线钢在管道凹陷状态下的应变演变特征**

Authors: Zhu, Lixia ; Wu, Gang ; Li, Lifeng ; Luo, Jinheng ; Tian, Ye ; Xu, Chunyan ; Lin, Rui

Author affiliation: CNPC Tubular Goods Research Institute, Xi'an; Shaanxi; 710077, China

State Key Laboratory of Performance and Structural Safety for Petroleum Tubular Goods and Equipment Materials, Xi'an; Shaanxi; 710077, China

PetroChina West Pipeline Company, Urumqi; Xinjiang; 830013, China

Oil & Gas Storage and Transportation Company, PetroChina Xinjiang Oilfield Company, Urumqi; Xinjiang; 831100, China

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In the process of construction and service, high-grade line pipes will get defective, e.g. dents, which will change its stress and strain distribution characteristics and impact its service reliability. In this paper, a X80 line pipe was taken as the research object. The distribution characteristics of the strain field in the X80 line pipe with plain dents with the change of dent depth under external load were analyzed using the finite element analysis software ABAQUS. Then, the strain distribution and microstructure characteristics in the dent zone were explored by conducting prefabrication test on physical dent. Finally, combined with the finite element simulation results, the strain distribution laws of the X80 line pipe with plain dent were discussed. And the following research results were obtained. First, under the same internal pressure, the strain distribution characteristics in the dent zone at different dent depths are similar, i.e., the strain increases with the increase of the distance from the center of the dent, and decreases rapidly with the increase of the distance after the peak strain. Second, the strain increases with the increase of dent depth, and under the same internal pressure and dent depth, the axial strain is larger than the radial strain at the same location. Third, the greater the dent depth, the stronger the superposition effect of internal pressure and depth on the strain. Fourth, strain hardening occurs on the materials in the initial stage of the dent deformation. With the aggravation of deformation and the extension of dent radius, the strain response ability of materials increases, the grains at the bottom and side walls of the dent zone are elongated along the direction of maximum deformation, the lattice is distorted and strain hardening occurs. As a result, the dislocation density in this zone increases and the interaction occurs between dislocations, as a result, the strength of line steel is enhanced. In conclusion, the research results do well in predicting the stress-strain evolution laws in the process of dent, and provide a theoretical foundation and an experimental basis for studying the influence of mechanical damage on the service safety of pipelines.

Number of 21

references:

Main heading: Finite element method

Controlled terms: ABAQUS - Deformation - Microstructure - Pipeline bends - Strain - Strain hardening

Uncontrolled terms: Dent - Dent depth - Finite element simulations - Line pipes - Microstructure characteristics

Classification code: 537.1 Heat Treatment Processes - 619.1 Pipe, Piping and Pipelines - 921 Mathematics - 921.6 Numerical Methods - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.07.015

Database: Compendex

167.

Accession number: 20193207285670

Title: **Low-frequency sparse double-constrained broadband seismic impedance inversion**

Authors: Wen, Xiaotao ; Yang, Jixin ; Li, Leihao ; He, Jian ; Li, Bo

Author affiliation: College of Geophysics, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation//Chengdu University of Technology, Chengdu; Sichuan; 610059, China

Corresponding author: Yang, Jixin (245164012@qq.com)

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Publication year: 2019

Pages: 45-52

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The reflection coefficient solved by using the traditional impedance inversion method cannot reflect low-frequency

information sufficiently and its continuity and resolution are limited, so the quality and resolution of impedance inversion is impacted seriously. In this paper, the advantages of rich low-frequency signals were discussed with the theoretical synthetic seismogram and wavelet simulation as the fulcrum. Then, the low-frequency sparse double-constrained reflection coefficient method was introduced to modify the sparse optimization item, and thus a new method was formed. Finally, based on the broadband data and non-broadband data of the actual work area, the reflection coefficient and impedance inversion solved by the traditional basis-pursuit reflection coefficient inversion were compared and then the calculation results of low-frequency sparse double-constrained reflection coefficient inversion were compared to verify the effect of the modified method. And the following research results were obtained. First, the broadband data with rich low-frequency information is less affected by the side lobe, and its seismic data resolution is higher, which is more favorable for the improvement of inversion accuracy and resolution. Second, in the new method, L2 norm low-frequency model is added on the basis of BPDN basis-pursuit denoising problem to constrain the residual, so as to realize the direct solution of the reflection coefficient with low-frequency information. Third, the reflection coefficient and wave impedance solved by using the new method have better continuity and resolution than those solved by using the traditional method and they are in good agreement with the well data. In conclusion, the new method achieves higher resolution on the impedance inversion of broadband data and non-broadband data and the accuracy of impedance inversion is increased, so it has a higher application value in predicting the distribution of thin reservoirs.

Number of references: 21

Main heading: Reflection

Controlled terms: Compressed sensing - Constrained optimization - Seismology

Uncontrolled terms: Broadband - High resolution - Impedance inversion - Low-frequency - South China sea

Classification code: 484.1 Earthquake Measurements and Analysis - 716.1 Information Theory and Signal Processing - 961 Systems Science

DOI: 10.3787/j.issn.1000-0976.2019.05.005

Database: Compendex

168.

Accession number: 20193207284627

Title: **Mid-term evaluation and prospect of the implementation of the 13th Five-Year Plan for the National Oil and Gas Resources Exploration and Mining Plan**

Authors: Guo, Wei ; Pan, Jiping

Author affiliation: Oil & Gas Resources Strategy Research Center, Ministry of Natural Resources, Beijing; 100034, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: April 25, 2019

Publication year: 2019

Pages: 111-117

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Since more than half of the "13th Five-Year Plan" has been carried out, it is conducive to enhancing domestic oil and gas supply capacity to conduct the mid-term evaluation of oil and gas resources exploration and development planning, to timely discover trends and risks, and to put forward opinions and suggestions. In view of this, based upon the 13th Five-Year Planning reports on Oil & Gas Development, this paper, in combination with economic situation at home and abroad, evaluates the goal accomplishment and progress in implementing key tasks related to oil and gas reserves and productivity, discusses the major problems at present, and finally puts forward suggestions on enhancing the implementation of planning. The evaluation results demonstrate that by the end of 2018, the new proved geological reserves of oil, natural gas, coalbed methane gas (CBM) and shale gas basically had met the planning expectations; several hundred million ton oil fields like Nanliang, Huanjiang, etc. in the Ordos Basin, and several gas fields of 100 billion cubic meter like the Sulige gas field in the Ordos Basin, the Anyue gas field in the Sichuan Basin, and so on, had been discovered. Besides, the output of oil has declined for three consecutive years, and the output of natural gas has increased steadily, showing a trend of "oil down and gas up", which shows the sustainable development of oil and gas is more severe. The following conclusions are thus achieved. (1) Although the implementation of the plan is generally good, it is

still necessary in recent years to take effective measures to fully promote the growth of oil and gas reserves and production, and ensure the security of the national energy supply. (2) Deep basins and deep-water basins will become the key potential areas for future oil and gas reserves and output increment, and will be the strategic replacement areas for oil and gas resources exploration and development in China. (3) The proportion of unconventional oil and gas will gradually increase, and tight oil and gas, shale gas, CBM and natural gas hydrate will become an important part of energy reserves increase. (4) China will enter a rapid- growth stage of natural gas reserves and production.

Number of references: 20

Main heading: Proven reserves

Controlled terms: Coal deposits - Energy resources - Gallium - Gas hydrates - Gas industry - Gases - Metamorphic rocks - Methane - Natural gas - Offshore gas fields - Reserves to production ratio - Shale gas

Uncontrolled terms: China - Five-year plans - Medium term - Reserves - Unconventional oil and gas - Yield rates

Classification code: 503 Mines and Mining, Coal - 512 Petroleum and Related Deposits - 522 Gas Fuels - 525.1 Energy Resources and Renewable Energy Issues - 549.3 Nonferrous Metals and Alloys excluding Alkali and Alkaline Earth Metals - 804.1 Organic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.04.015

Database: Compendex

169.

Accession number: 20193207285120

Title: **Geochemical characteristics and sources of natural gas in the northern Xihu Sag**

Authors: He, Liwen ; Chen, Jianfa ; Liu, Kaixuan ; Zhu, Xinjian ; Zhang, Chao ; Li, Wei ; Luo, Guangping ; Wang, Yangyang ; Zhao, Xingqi ; Wu, Jianjun

Author affiliation: State Key Laboratory of Petroleum Resources and Prospecting//China University of Petroleum, Beijing; 102249, China

Key Laboratory of Crustal Dynamics, Institute of Crustal Dynamics, China Earthquake Administration, Beijing; 100085, China

CNNC Key Laboratory of Uranium Resources Exploration and

Evaluation Technology, Beijing Research Institute of Uranium Geology, Beijing; 100029, China

PetroChina Tarim Oilfield Company, Korla; Xinjiang; 841000, China

Corresponding author: Chen, Jianfa (jfchen@cup.edu.cn)

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The Xihu Sag in the East China Sea Basin is rich in natural gas resources, but the sources of its natural gas have always been controversial. The existing researches mostly adopt the source rock maturity for gas source correlation without any direct evidence. In this paper, the large- and medium-sized gas fields discovered in the northern Xihu sag in recent years were taken as the research objects. After compositions, carbon isotopes and light hydrocarbon compositions of the natural gas in this area were analyzed, the geochemical characteristics and genesis types of natural gas were studied systematically. Then, combined with the thermal evolution of source rocks and the carbon isotope of kerogen, the sources of natural gas were analyzed and its migration modes and pathways were discussed. And the following research results were obtained. First, the natural gas of Huagang Fm in the northern Xihu Sag is mainly coal-type gas, which is generated from humic kerogen via primary cracking. It is mainly dry gas in the central uplift and wet gas in the west subsag. Second, the maturity of the source rocks in this area gradually increases from the south to the north, resulting in a higher maturity of natural gas in the central uplift and a lower maturity of natural gas in the west subsag. Third, though the source rocks of the Huagang Fm and the lower Pinghu Fm have different contributions to the natural gas in the northern part of the Xihu Sag, the natural gas there is mainly derived from the coal-bearing source rocks of Pinghu Fm. Among them, the coal-bearing source rocks of the Huagang Fm in the central uplift are

of higher maturity and contribute more to the natural gas in this area. Fourth, the natural gas in this area is characterized by vertical migration and fractionation. After the Longjing movement, the fault is reactivated and provides a favorable pathway for the upward migration of natural gas from Pinghu Fm and its lower formations.

Number of references: 40

Main heading: Gases

Controlled terms: Carbon - Coal - Coal deposits - Exploratory geochemistry - Gas industry - Hydrocarbons - Isotopes - Kerogen - Natural gas - Offshore gas fields - Oil shale - Petroleum deposits - Rocks

Uncontrolled terms: Carbon isotopes - Coal types - Coal-bearing source rocks - East China Sea - Eocene - Light hydrocarbon - Northern Xihu Sag - Oligocene - Vertical migration

Classification code: 481.2 Geochemistry - 503 Mines and Mining, Coal - 512.1 Petroleum Deposits - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 524 Solid Fuels - 804 Chemical Products Generally - 804.1 Organic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.05.006

Database: Compendex

170.

Accession number: 20193207284688

Title: **Prediction and control of casing damage in large volume fracturing of horizontal gas wells**

Authors: Li, Fanhua ; Dong, Kai ; Fu, Pan ; Qiao, Lei ; Du, Weiqiang ; Sun, Qinghua

Author affiliation: CNPC Engineering Technology Research Institute, Beijing; 102206, China

CNPC Greatwall Drilling Company, Beijing; 100101, China

China University of Petroleum, Beijing, Beijing; 102249, China

Corresponding author: Dong, Kai (dongkai.gwdc@cnpc.com.cn)

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Pages: 69-75

Language: Chinese

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The casing damage/deformation in shale gas horizontal wells caused by massive volume fracturing has always been a problem in the process of field construction, and it has a great impact on the field construction efficiency and the economic benefit of development project. To solve this problem, this paper analyzed the fracturing data of more than 100 horizontal wells in the Weiyuan Shale Gas Block of the Sichuan Basin. Then, the causes and laws of casing damage/deformation of shale gas horizontal wells in this block were discussed. And based on the analysis results, a prediction and control method was proposed. And the following research results were obtained. First, the main geological engineering factors for the occurrence of casing deformation are reservoir geological characteristics, ground stress and fracturing scale. Second, mud logging and well logging interpretation can be taken as the basis for casing deformation prediction in the hole sections where casing damage tends to happen easily, e.g. the horizontal section in the Upper Ordovician Wufeng Fm where the petrophysical properties are particularly heterogeneous, the sweet spot areas are thin and the reservoirs can hardly absorb the "energy" from massive volume fracturing, the hole section near the target A, and the hole section with lost circulation in natural fracture interval. Third, as for the shale gas horizontal wells whose production is controlled by the trajectory of horizontal section, it is necessary to increase the steering level during the drilling of horizontal section so as to keep its trajectory in the sweet spot areas which are precisely characterized in geological gas reservoir engineering. Fourth, for the horizontal sections in the reservoirs of strong heterogeneity, it is suggested to adopt engineering technical measures of "segment completion, section cementing", optimization of well spacing, and appropriate reduction of fracturing scale.

Number of references: 9

Main heading: Horizontal wells

Controlled terms: Deformation - Forecasting - Fracture - Gas engineering - Gases - Geology - Mud logging - Petroleum reservoirs -

Petrophysics - Shale gas - Well spacing

Uncontrolled terms: Casing damage - Casing deformation - Ground stress - Horizontal well fracturing - Prediction and control - Sichuan Basin - Weiyuan Block

Classification code: 481.1 Geology - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.04.009

Database: Compendex

171.

Accession number: 20193207284746

Title: **Characteristics and controlling factors of deep-buried clastic reservoirs in the Qiulitage structural belt, Tarim Basin**

Authors: Chen, Ge ; Zhao, Jilong ; Yang, Xianzhang ; Liu, Chun ; Deng, Yi

Author affiliation: PetroChina Hangzhou Research Institute of Geology, Hangzhou; Zhejiang; 310023, China

Tarim Basin Center, PetroChina Research Institute of Petroleum Exploration & Development, Tarim; Xinjiang; 840000, China

PetroChina Tarim Oilfield Company, Korla; Xinjiang; 841000, China

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: A great breakthrough was recently achieved in the Qiulitage structural belt, Tarim Basin, but no better understandings have ever been obtained of the accumulation mechanism and controlling factors of the Lower Cretaceous Bashijiqike Fm Clastic reservoirs. In order to provide technical support for further exploration target optimization and oil & gas

development in this study area, we, based upon the drilling, core logging, thin section analysis data and other well logging and test information, discussed the characteristics and controlling factors of reservoirs there. The following results were achieved. (1) The rock types of the Lower Cretaceous Bashijiqike Fm are dominated firstly by lithic sandstones, and secondly feldspar lithic sandstones, characterized by a low amount of quartz and feldspar, high content of debris, low compositional maturity, and medium textural maturity. (2) The reservoir spaces include primarily inter-granular pores, inter-granular dissolution pores and secondary fractures. The reservoir rock physical property was bad, which suggests a reservoir of low porosity and low permeability. The pore structure is featured by high discharge pressure, small pore throat radius, small amount of mercury, and fine pore throat so that low-porosity and low-permeability porous reservoir was eventually formed there. (3) The reservoir properties are affected by sedimentation, diagenesis, tectonic action, gypsum rock layers and burial depth, etc., among which lithofacies, dissolution and tectonic compression are the main controlling factors, while corrosion and structural extrusion are the key factors to favorable reservoir properties. (4) The reservoir evolution mode is divided into five stages, i.e., long-term shallow-buried inter-granular pore development, strong cementation and pore reduction during the early diagenetic period, dissolution and pore-enhancement during the early supergene period, continuous maintenance of pores during the middle diagenetic period, and fractures connecting pores to improve reservoir performance during the late diagenetic period.

Number of references: 23

Main heading: Low permeability reservoirs

Controlled terms: Corrosion - Dissolution - Feldspar - Oil field development - Oil well drilling - Oil well logging - Oil well testing - Petroleum prospecting - Petroleum reservoir engineering - Pore structure - Porosity - Sandstone - Tectonics - Well logging

Uncontrolled terms: Clastic - Controlling factors - Deep-buried - Early Cretaceous - Reservoir characteristic - Structural belt - Tarim Basin

Classification code: 481.1 Geology - 482.2 Minerals - 511.1 Oil Field Production Operations - 512.1 Petroleum Deposits - 512.1.2 Petroleum Deposits : Development Operations - 802.3 Chemical Operations - 931.2 Physical Properties of Gases, Liquids and Solids

DOI: 10.3787/j.issn.1000-0976.2019.04.003

Database: Compendex

172.

Accession number: 20193207284451

Title: **Hydrocarbon accumulation conditions and evolution process of the ZQ1 large condensate gas reservoir in the Qiulitage structural belt, Tarim Basin**

Authors: Liu, Chun ; Xu, Zhenping ; Chen, Ge ; Deng, Yi ; Wang, Junpeng ; Zhao, Jilong

Author affiliation: PetroChina Hangzhou Research Institute of Geology, Hangzhou; Zhejiang; 310023, China

PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

School of Geosciences & Technology, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

PetroChina Tarim Oilfield Company, Korla; Xinjiang; 841000, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In December 2018, a high-yield industrial gas flow was achieved in the test of Well ZQ1 from the Cretaceous Bashijiqike Fm, which was a major breakthrough in natural gas exploration in the Qiulitage structural belt of the Tarim Basin, where the largest condensate gas reservoir has been discovered so far. In order to provide evidences for further oil and gas exploration in this structural belt, this paper made full use of the previous research results, based on the core, thin section, logging and geochemical analysis data of this well, clarified the types and characteristics of this gas reservoir. Also, the gas accumulation conditions of this gas reservoir was analyzed, a gas accumulation model was established, and its evolution process was then deduced. The following results were presented. (1) The ZQ1 large gas reservoir

belongs to a condensate gas reservoir with condensate oil, and with coal-derived gas mainly derived from the Jurassic humus-type coal-series source rocks in this area. (2) The geological conditions in this structural belt include the super-thick and high-revolutionary source rocks developed in the Triassic and Jurassic, large effective sandstone reservoirs developed in the Cretaceous large braided river delta, large wedge-shaped tectonic traps that formed due to tectonic activities since the late Himalayan period, and Paleogene and Neogene thick salt rocks provide superior preservation conditions for the gas reservoir formation and good time-space matching of hydrocarbon generation and trap formation. (3) The "first oil and then gas" accumulation process of this condensate reservoir is overally characterized by "oil accumulated at the earlier stage, gas invasion at the later stage, and rapid pooling". It is concluded that hydrocarbon accumulation conditions are superior in the Qiulitage structural belt and it has broad prospects of oil and gas exploration in Tarim Basin. In conclusion, this structural belt with favorable oil and gas conditions presents a good hydrocarbon exploration prospect.

Number of references: 27

Main heading: Petroleum prospecting

Controlled terms: Analytical geochemistry - Exploratory geochemistry - Flow of gases - Gas condensates - Gases - Geological surveys - Natural gas wells - Oil well logging - Petroleum reservoir engineering - Petroleum reservoirs - Soils - Tectonics

Uncontrolled terms: Accumulation conditions - Condensate gas reservoirs - Early Crateceous - Exploration prospects - Reservoir-caprock assemblage - Structural belt - Tarim Basin

Classification code: 481.1 Geology - 481.2 Geochemistry - 483.1 Soils and Soil Mechanics - 512 Petroleum and Related Deposits - 522 Gas Fuels - 631.1.2 Gas Dynamics

DOI: 10.3787/j.issn.1000-0976.2019.04.002

Database: Compendex

173.

Accession number: 20195107877712

Title: **Structural deformation characteristics and shale gas preservation conditions in the Zhaotong National Shale Gas Demonstration Area along the southern margin of the Sichuan Basin**

Title of **四川盆地南缘昭通页岩气示范区构造变形特征及页岩气保存条件**

translation:

Authors: Xu, Zhengyu ; Liang, Xing ; Lu, Huili ; Zhang, Jiehui ; Shu, Honglin ; Xu, Yunjun ; Wu, Jinyun ; Wang, Gaocheng ; Lu, Wenzhong ; Tang, Xiehua ; Shi, Wenrui

Author affiliation: Hangzhou Research Institute of Petroleum Geology, PetroChina, Hangzhou; Zhejiang; 310023, China

PetroChina Zhejiang Oilfield Company, Hangzhou; Zhejiang; 310023, China

State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Source title: Natural Gas Industry

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The Zhaotong National Shale Gas Demonstration Area along the southern margin of the Sichuan Basin is located in the complex marine tectonic area of South China, where shale deformation and reformation are intense and the factors controlling sweet spots are complex, so the preservation conditions have an important impact on the enrichment of shale gas. In order to support the selection and evaluation of shale gas sweet spots in this area and improve the success rate of drilling, this paper carried out a geological survey on field outcrops. Then, based on drilling, mud logging and physical property test data, the structural deformation pattern and the regional deformation characteristics of this demonstration area were analyzed, and the development characteristics of formation joints and fractures, the sealing capacity of shale surrounding rock and the distribution characteristics of gas reservoirs were studied. Finally, the preservation conditions of shale gas in the Wufeng Formation of Upper Ordovician and the Longmaxi Formation of Lower Silurian were discussed. And the following research results were obtained. First, in the Zhaotong National Shale Gas Demonstration Area, three structural deformation patterns are

developed from south to north, including trough type, equal amplitude type and baffle type, which are distributed in three major deformation zones, respectively, i.e., the shear deformation zone of Central Guizhou Uplift, the compression-torsion deformation zone of Northern Yunnan-Guizhou Depression and the compression deformation zone of Southern Sichuan Depression. Second, three types of joints and fractures whose relationships with the direction of strata are high angle, middle-low angle and bedding intersection are developed in the Wufeng Formation-Longmaxi Formation and its overlying strata, and their occurrence characteristics are basically consistent with those of the three major deformation zones. Third, the shale of Wufeng Formation-Longmaxi Formation is thick in the north and thin in the south and possesses the preservation conditions of source-reservoir integration and self-sealing hydrocarbon accumulation. And combined with the sealing ability of the overburden strata and the roof and floor, its preservation conditions are overall better. Fourth, from the perspective of shale gas component, this area can be divided into three belts, i.e., methane, methane + nitrogen mixture and nitrogen from north to south. And the preservation conditions of shale gas are generally better in the north and worse in the south. In conclusion, the shale in the central-northern part of Zhaotong National Shale Gas Demonstration Area (compression deformation area and its southern margin) is the most favorable area because of its large shale thickness, weak reformation and deformation, bedding development of joints and fractures, good sealing performance and excellent preservation conditions. The compression-torsion deformation zone of Northern Yunnan-Guizhou Depression in the central part is moderate in preservation conditions, and it is the relatively favorable area. The shear deformation zone of Central Guizhou Uplift in the southern part has poor preservation conditions, and it is a prospective area.

Number of references: 22

Main heading: Shale gas

Controlled terms: Demonstrations - Fracture - Gases - Infill drilling - Joints (structural components) - Methane - Mud logging - Nitrogen - Petroleum reservoirs - Shear deformation - Torsional stress

Uncontrolled terms: Displacement pressure - Preservation condition - Silurian - Structural deformation - Zhaotong

Classification code: 408.2 Structural Members and Shapes - 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 804 Chemical Products Generally - 804.1 Organic Compounds - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.10.003

Database: Compendex

174.

Accession number: 20200208027849

Title: **Relation and contribution rate of graptolite to organic matter enrichment in shale: A case study from Well YS118 at the southern margin of the Sichuan Basin**

Title of translation: **笔石与页岩有机质的富集关系及其贡献率--以四川盆地南缘YS118井为例**

Authors: Li, Jilin ; Zhang, Tingshan ; Lin, Dan ; Zhang, Wanli ; Liu, Jun ; Li, Hong ; Li, Yanjun

Author affiliation: School of Geosciences and Technology, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Sichuan Key Laboratory of Shale Gas Evaluation and Exploitation, Guanghan; Sichuan; 618300, China

Sichuan Keyuan Engineering Technology Testing Center, Guanghan; Sichuan; 618300, China

Sulige Gasfield Development Company, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710018, China

No.2 Oil Production Plant, PetroChina Changqing Oilfield Company, Qingyang; Gansu; 745000, China

Chongqing Division, PetroChina Southwest Oil & Gasfield Company, Chongqing; 400021, China

Corresponding author: Zhang, Tingshan (zts_3@126.com)

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: High-carbon content and graptolite-rich black shale is developed in the Lower Silurian Longmaxi Formation in the southern China. Graptolite acts as important biological inputs to shale, but its effects on organic matter enrichment and its hydrocarbon generation mechanisms are currently less researched. Moreover, no common agreement has been reached in terms of the effects of graptolite on organic matter enrichment. To deal with this situation, this paper analyzed the elemental compositions of graptolite based on the analysis and test results of 124 shale samples taken from the base of the Longmaxi Formation in the typical well YS118 at the southern margin of the Sichuan Basin, including graptolite abundance, whole-rock total organic carbon (TOC), surrounding rock TOC, and energy spectrum of graptolite and surrounding rock. Then, the vertical variation characteristics of graptolite abundance in the high-quality shale interval at the base of the Longmaxi Formation were elucidated. Finally, the correlation between graptolite abundance and organic matter enrichment was explored in the P. persculptus and C. vesiculosus belts to quantitatively characterize the contribution of graptolite abundance to organic matter in different belts. And the following research results were obtained. First, carbon is the main element in the graptolite of the Longmaxi Formation shale, and its content is higher, ranging from 27.23% to 32.25%. Second, graptolite has a higher TOC content and greater carbon enrichment than the surrounding rocks. Third, the whole-rock TOC is obviously higher than the surrounding rock TOC, graptolite abundance is well correlated with the whole-rock TOC, and graptolite is an important contributor to the organic matters of shale. Fourth, the contribution rates of graptolite in the P. persculptus and A. ascensus belts to organic matters are 58.5% and 55.3%, respectively, suggesting that graptolite is the primary source for the organic matters of shale, while those in the P. acuminatus and C. vesiculosus belts are 24.23% and 13.65%, respectively, and the organic matter enrichment is under the joint control of graptolite and other organisms. In conclusion, graptolite abundance can well reflect the enrichment degree of organic matters in shale.

Number of references: 25

Main heading: Shale

Controlled terms: Biogeochemistry - Organic carbon

Uncontrolled terms: Carbon elements - Contribution rate - Graptolite abundance - Longmaxi Formation - Sichuan Basin - Silurian

Classification code: 481.2 Geochemistry - 804.1 Organic Compounds

Numerical data Percentage 1.37e+01%, Percentage 2.42e+01%, Percentage

indexing: 2.72e+01% to 3.22e+01%, Percentage 5.53e+01%, Percentage 5.85e+01%

DOI: 10.3787/j.issn.1000-0976.2019.12.005

Database: Compendex

175.

Accession number: 20195107877736

Title: **A new design concept of pipeline network with interconnected trunk lines for energy saving, cost reducing and efficiency increasing in CBM fields**

Title of translation: **煤层气田节能降本增效的干管互通式管网设计新思路**

Authors: Meng, Fanhua ; He, Zhuo ; Li, Xiaoping ; Wang, Zihui ; Liu, Ruijuan

Author affiliation: CBM Branch Company, PetroChina Huabei Oilfield Company, Changzhi; Shanxi; 046000, China

CNPC CBM Exploitation Pilot Base, Changzhi; Shanxi; 046000, China

National Engineering Laboratory for Pipeline Safety//MOE Key Laboratory of Petroleum Engineering, Beijing Key Laboratory of Urban Oil and Gas Distribution Technology, China University of Petroleum, Beijing; 102249, China

Corresponding author: Li, Xiaoping (lxpmpf@cup.edu.cn)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: At present, coalbed methane (CBM) development in the Qinshui Basin has been transformed into multi-well cluster deployment

mode from the earlier single-well deployment mode. In order to optimize the CBM gathering and transportation system in the Qinshui Basin further and deal with the "three highs" problem (high energy consumption, high investment and high idling rate of equipment) existing in the current CBM gathering and transportation system, with the demands of two stages (i.e., system development and operation) taken into consideration comprehensively, this paper established the corresponding economic benefit calculation model and optimization model. Then, combined with the economic and technological analysis and software numerical simulation, a new design concept of "pipeline network with interconnected trunk lines" was put forward. That is to build and lay connecting pipelines between different blocks to make the equipment spare to each other, so that the idling rate of equipment can be reduced effectively. And the following research results were obtained. First, the adoption of the design concept of pipeline network with interconnected trunk lines can realize the interconnection of gas production systems and increase the flexibility of the pipeline network, so as to effectively increase the average station load rate, equipment utilization rate and operation efficiency, reduce energy consumption, and improve economic benefit. Second, the application effect of this concept to the productivity construction of 4×10 m/a in a certain block of the Qinshui Basin shows that the investment in the system is reduced by 20%, the average station load rate increased by 30%, the operation efficiency increased by 10%, the operation energy consumption reduced by 20%, and the benefit increased by over CNY 20 million. In conclusion, this design concept is of an important guiding significance to the development and construction of new blocks in CBM fields in the future.

Number of references: 16

Main heading: Energy efficiency

Controlled terms: Coal bed methane - Coal deposits - Computer software - Economic and social effects - Economics - Energy utilization - Firedamp - Investments - Methane - Natural gas wells - Optimization - Pipelines

Uncontrolled terms: High-efficiency - Low consumption - Qinshui basin - Transportation pipelines - Trunk lines

Classification code: 503 Mines and Mining, Coal - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 525.2 Energy Conservation - 525.3 Energy Utilization - 619.1 Pipe, Piping and Pipelines - 723 Computer Software, Data Handling and Applications - 804.1 Organic Compounds - 921.5 Optimization Techniques - 971 Social Sciences

Numerical data indexing: Percentage 1.00e+01%, Percentage 2.00e+01%, Percentage 3.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.10.012

Database: Compendex

176.

Accession number: 20193207285072

Title: **Hydrocarbon charging and reservoir densification of the deep-seated glutenite gas reservoirs in the Bozhong Sag**

Authors: Wang, Qingbin ; Niu, Chengmin ; Liu, Xiaojian ; Zang, Chunyan ; Zhao, Meng ; Wang, Jun ; Hao, Yiwei ; Wan, Lin

Author affiliation: College of Earth Sciences, Jilin University, Changchun; Jilin; 130061, China

Tianjing Branch, CNOOC China Limited, Tianjin; 300459, China

CNOOC EnerTech-Drilling & Production Co., Tianjin; 300452, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The glutenite reservoirs in the Bozhong Sag of the Bohai Bay Basin are characterized by dense lithology, poor reservoir physical property and late-stage hydrocarbon accumulation. And so far, no reasonable explanation has been reached on the relationship between the reservoir densification and the late hydrocarbon emplacement. In this paper, a Paleogene glutenite gas reservoir in the southwest of Bozhong Sag was taken as a research object. Its initial hydrocarbon accumulation time was determined, its hydrocarbon charging period was divided and its reservoir physical properties in the period of hydrocarbon accumulation were restored by using the analysis data of physical property, thermal history and inclusion. Then, the effect of compaction on the reservoir was simulated by means of compaction simulation test, and the relationship of hydrocarbon

emplacement was figured out by conducting the experiments of inclusions, casting, scanning electron microscope (SEM) and X-ray diffraction. Finally, the sequence of key densification effects was analyzed, including quartz enlargement, clay mineral transformation and carbonate cementation, and the reservoir densification mechanism and its relationship with hydrocarbon charging were investigated. And the following research results were obtained. First, hydrocarbon charging in the deep-seated glutenite reservoir of the study area can be divided into 3 periods. Inclusion in the early period is heavy oil and that in the late period is of high gas/oil ratio. Second, the first hydrocarbon charging to date from 5 Ma, when the burial depth of the reservoir was in the range of 2 500-2 800 m, the reservoir of medium porosity and medium permeability was dominant and the reservoir physical properties were better. After hydrocarbon accumulation, the basin subsided and was filled quickly and its overlying strata are over 1 000 m thick. Third, after the first hydrocarbon charging, glutenite experienced a rapid diagenetic evolution at the burial depth of 2 500-3 200 m, which is classified as the rapid compaction stage of glutenite. After hydrocarbon charging, quartz experienced violent overgrowth of two phases and porosity reduction was obvious. Therefore, compaction and porosity reduction are the main mechanisms of reservoir densification. Fourth, at the burial depth of 2 500 m to 3 500 m, it is the rapid transformation zone of clay mineral in the study area and flower- like and the silk-like illite is quite developed, which has a decisive influence on the permeability. Fifth, ferrocalcite and ferrodolomite are precipitated after the quartz overgrowth and filled the residual pores, resulting in further reservoir densification. In conclusion, the Paleogene glutenite gas reservoir in the study area became dense after hydrocarbon accumulation, and diagenesis can still lead to reservoir densification even though it is suppressed by hydrocarbon charging.

Number of references: 24

Main heading: Petroleum reservoir engineering

Controlled terms: Clay minerals - Compaction - Crude oil - Densification - Gases - Heavy oil production - Hydrocarbons - Lithology - Petroleum reservoirs - Porosity - Quartz - Reservoirs (water) - Scanning electron microscopy

Uncontrolled terms: Bohai Bay Basin - Bozhong Sag - Charging periods - Deep layer - Densification mechanisms - Gas reservoir - Hydrocarbon accumulation - Paleogene

Classification code: 441.2 Reservoirs - 481.1 Geology - 482.2 Minerals - 511.1 Oil Field Production Operations - 512 Petroleum and Related Deposits - 802.3 Chemical Operations - 804.1 Organic

Compounds - 931.2 Physical Properties of Gases, Liquids and Solids

Numerical data indexing: Age 5.00e+06yr, Size 1.00e+03m, Size 2.50e+03m to 2.80e+03m, Size 2.50e+03m to 3.20e+03m, Size 2.50e+03m3 to 3.50e+03m3

DOI: 10.3787/j.issn.1000-0976.2019.05.003

Database: Compendex

177.

Accession number: 20200208027976

Title: **A new multi-disciplinary integrated steering technology for horizontal wells in tight sandstone gas reservoirs: A case study of the Ordos Basin**

Title of translation: **致密砂岩气藏水平井多学科综合导向新技术--以鄂尔多斯盆地为例**

Authors: Fei, Shixiang ; Du, Yubin ; Wang, Yijun ; Chen, Nan ; Gao, Yang ; Wang, Shuhui ; He, Liu

Author affiliation: Exploration and Development Research Institute, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710018, China

National Engineering Laboratory of Low-Permeability Oil & Gas Exploration and Development, Xi'an; Shaanxi; 710018, China

Gasfield Development Division, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710018, China

CNPC Changqing Branch of BGP Inc., Xi'an; Shaanxi; 710018, China

No.1 Gas Production Plant, PetroChina Changqing Oilfield Company, Xi'an; Shaanxi; 710000, China

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Language: Chinese

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The sandstone layers of the Upper Paleozoic tight clastic gas reservoirs in the Ordos Basin are generally distributed in a pattern of nearly NS strip, and the channel branches and intersects frequently. A single sand body is in a multilayered contact mode resulted from lateral accretion, and the sand bodies at the river intersections present a feature of lying in the nearly EW direction, which brings great difficulties to the geosteering of horizontal wells. In order to improve the reservoir drilling rate of horizontal wells, this paper systematically analyzed the geosteering status of horizontal wells and the sedimentary characteristics of reservoirs. Then, the spatial distribution of reservoirs was predicted using 3D geological modeling and 3D seismic. In addition, based on the cognitions on the space distribution of sand bodies from the drilled horizontal wells, the horizontal-well geosteering technology and method were constantly improved and enriched. Thus, an integrated steering technology of "fine sublayer correlation for target entering, geology in small scale, and seismic in large scale" based on in-depth integration of multidisciplinary thinking was newly formed, and it was also applied on site. And the following research results were obtained. First, under the guidance of the sedimentation model, the target entering process is controlled precisely and the success rate of one-trip target entering is improved, so it is one important method for the target steering of deviated hole sections. Second, geological modeling can guide the drilling of horizontal wells, but to some extent, it is deviated from the real underground geologic bodies, so it can be used as an auxiliary horizontal-well steering method. Third, 3D seismic steering can tell the boundary of complex river channel and discriminate the spatial relative location of predominant sand bodies, so it is the primary method for horizontal-well steering to provide excellent judgement and guidance on the steering of horizontal hole sections. Fourth, owing to the application of this new method in 62 horizontal wells drilled in the tight gas demonstration area, the average horizontal section length reaches 1 430 m, the average sandstone drilling rate is 86.2%, the average gas layer drilling rate is 70.2%, and the gas layer drilling rate of horizontal wells is increased by more than 10%.

Number of references: 17

Main heading: Horizontal wells

Controlled terms: 3D modeling - Gases - Geology - Horizontal drilling - Infill drilling - Metamorphic rocks - Petroleum reservoirs - Sand - Sandstone - Seismology - Tight gas - Well drilling

Uncontrolled terms: 3D seismic - Drilling rates - Geological modeling - Integrated steering - Multi-disciplinary - Ordos Basin - Sedimentation

model - Tight sandstone gas

Classification code: 481.1 Geology - 482.2 Minerals - 483.1 Soils and Soil Mechanics - 484.1 Earthquake Measurements and Analysis - 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 522 Gas Fuels

Numerical data indexing: Percentage 1.00e+01%, Percentage 7.02e+01%, Percentage 8.62e+01%, Size 1.43e+03m

DOI: 10.3787/j.issn.1000-0976.2019.12.007

Database: Compendex

178.

Accession number: 20193907482160

Title: **Effect of prestrain on strain response characteristics and tensile properties of X80 line pipe steel with weld zones**

Title of translation: **预应变对含焊缝区X80管线钢应变响应特征及拉伸性能的影响**

Authors: Wu, Gang ; Luo, Jinheng ; Xu, Guangda ; Zhu, Lixia ; Li, Lifeng ; Chen, Cuicui

Author affiliation: State Key Laboratory of Performance and Structural Safety for Petroleum Tubular Goods and Equipment Materials, Xi'an; Shaanxi; 710077, China

CNPC Tubular Goods Research Institute, Xi'an; Shaanxi; 710077, China

PetroChina West Pipeline Company, Urumqi; Xinjiang; 830013, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Under the effect of pressurization, a high-flux natural gas pipeline can be locally deformed in the process of its application,

and consequently the service safety of line pipe steel will be impacted severely. At present, the studies on the pre-deformation induced hardening phenomenon mainly focus on the base zones or weld zones, but the line pipe steel with weld zones is rarely researched. In this paper, X80 line pipe steel with weld zones was taken as the research object. Different tensile pre-deformation values were adopted to simulate the unidirectional tensile stress generated by pipeline pressurization. On this basis, the effect of work hardening induced by the collaborative strain of weld line and base material on the tensile properties of pipeline steel was studied. And the following research results were obtained. First, under the action of tensile stress, strain response occurs in weld zones and base zones. Second, larger crystalline grains in weld zones can effectively increase the flow resistance of crystalline boundary and internal dislocation, resulting in higher strain hardening capacity. And thus the yield strength of the weld zones is higher than that of the base zones when deformation occurs again, so the tensile process is mainly concentrated in the base zones. Third, the greater the pre-deformation is, the more significant the strain hardening phenomenon is. Fourth, due to the strong strain response in the weld zone, the fracture occurs in the base zone and the fracture morphology changes from the micro-pore aggregation to the quasi-cleavage fracture. In conclusion, the research results can provide a theoretical foundation and an experimental basis for the welding process design of X80 pipeline steel and the safety evaluation of high-flux natural gas pipelines.

Number of references: 19

Main heading: Welds

Controlled terms: Crystalline materials - Deformation - Fracture - Fracture mechanics - Natural gas - Natural gas pipelines - Pressurization - Steel pipe - Steel research - Strain hardening - Tensile properties - Tensile stress

Uncontrolled terms: Dimple - Fracture behavior - Linepipe steel - Pre-strain - Weld zone

Classification code: 522 Gas Fuels - 537.1 Heat Treatment Processes - 538.2 Welding - 545.3 Steel - 931.1 Mechanics - 933.1 Crystalline Solids - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.07.016

Database: Compendex

179.

Accession 20195107877609

number:

Title: **Geo-steering technology for horizontal wells in deep karst Dengying reservoirs of the Gaoshiti gas field, Central Sichuan Basin**

Title of translation: **四川盆地中部高石梯地区深层岩溶储层水平井地质导向技术**

Authors: Zhang, Shudong ; Hu, Hua ; Zhang, Yu ; Ji, Ren ; Wang, Anqing ; Li, Chunmei ; Wang, Ping

Author affiliation: Southwest Branch of PetroChina Logging Co., Ltd., Chengdu; Sichuan; 610051, China

Exploration Division of PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

Southwest Geophysical Research Institute, CNPC BGP Inc., Chengdu; Sichuan; 610014, China

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Language: Chinese

ISSN: 10000976

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The Upper Sinian Dengying Formation in the Gaoshiti gas field, Central Sichuan Basin, has always been the major payzone of natural gas exploration and development in this basin up till now. But due to the complexity of siliceous and heterogeneous reservoirs there such as high temperature, high pressure, high H2S content, well-developed pores and fractures, frequent sticking and leakage often occur along with high risks of blowout during horizontal-well drilling, which even makes geo-steering, and reservoir tracing and orientation difficult. In view of this, based on the analysis of geological and drilling characteristics of Dengying reservoirs and the summary of actual drilling data, we put forward a geological modeling technology for multi-well lithofacies interpretation and reservoir comparative analysis, fracture and hole detection through comprehensive logging, geology and seismic data; then by combining the real-time geo-steering technology of reservoir identification with evaluation with LWD data, reservoir seismic

model and cutting element analysis, we focused on the optimization of such aspects as the inclination angle at the top of Dengying Fm, the trajectory plan for the build-up section, the suitable string and the directional operation scheme, and the well trajectory technology for avoiding siliceous and tight layers, and finally formed an integrated geo-steering technology suitable for the geological and engineering characteristics of the Dengying reservoirs. The field practices of five wells show that this presented method is worth popularizing in that the drilling goal with geological guidance has been achieved; that effective reservoir drilling rate and drilling efficiency have been increased; that operation risks have been reduced; and that the needs of geological guidance under complex geological and borehole engineering conditions in this area have been met.

Number of references: 19

Main heading: Petroleum reservoir evaluation

Controlled terms: Boreholes - Directional logging - Gas industry - Geology - Horizontal drilling - Horizontal wells - Infill drilling - Natural gas fields - Petroleum prospecting - Seismology - Trajectories - Well drilling

Uncontrolled terms: Central Sichuan Basin - Gaoshiti - Geological modeling - Karst reservoirs - Late Sinian - Well trajectory

Classification code: 481.1 Geology - 484.1 Earthquake Measurements and Analysis - 511.1 Oil Field Production Operations - 512 Petroleum and Related Deposits - 522 Gas Fuels

DOI: 10.3787/j.issn.1000-0976.2019.10.005

Database: Compendex

180.

Accession number: 20193907482175

Title: **Effect of typical ions on the corrosion behavior of carbon steel in CO2 environment**

Title of translation: **典型离子对碳钢CO2腐蚀的影响**

Authors: Gu, Tan ; Tang, Dezhi ; Wang, Zhu ; Chen, Hongjian ; Xie, Hongjun

Author affiliation: PetroChina Planning and Engineering Institute, Beijing; 100083, China

Beijing Lingyi Science and Technology Co., Ltd., Beijing; 100083, China

Institute for Advanced Materials and Technology, University of

Science & Technology Beijing, Beijing; 100083, China

Corresponding author: Tang, Dezhi (dztangcp@126.com)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to investigate the effect of typical ions in produced liquids in oil and gas fields on the pipeline corrosion behavior in CO2 environment, the corrosion behavior of carbon steel (N80 steel) in the environment with Cl, SO4, Ca, HCO3 and CO2 was studied by means of corrosion simulation experiments, combined with the electrochemical method (e.g. polarization test and AC impedance spectroscopy test) and pH analysis method. And the following research results were obtained. First, Cl and SO4 have a similar effect on the corrosion behavior of N80 steel, while Ca and HCO3 can inhibit the corrosion to some extent. Moreover, the inhibition effect of HCO3 is better than that of Ca. Second, the variation of pH value after the addition of Cl and Ca is negligible. However, the addition of SO4 or HCO3 results in the increase of pH value. Third, Ca participates in the generation of corrosion product film, leading to the decrease of its porosity. Therefore, the corrosion rate and the inductive reactance arc decrease in the environment of this medium. Fourth, the existence of HCO3 increases the pH value of the solution and decreases the corrosion of the solution. And it also leads to the increase of CO3 concentration and promotes the deposition of FeCO3 to make the corrosion product film more compact and complete, so that the inductive reactance arc measured in HCO3-containing solution disappears and the corrosion rate of the material declines greatly. In conclusion, the research results provide a technical and theoretical support for the corrosion control in the petrochemical industry.

Number of references: 28

Main heading: Steel corrosion

Controlled terms: Carbon dioxide - Carbon steel - Corrosion - Corrosion inhibitors - Corrosion rate - Corrosive effects - Electric impedance - Electrochemical impedance spectroscopy - Gas industry - Ions - Iron compounds - Oil fields - Petroleum reservoirs - pH - Pipeline corrosion - Polarization - Spectroscopy

Uncontrolled terms: Ac impedance spectroscopy - HCO3^- - Inductive reactance - Oil and gas fields - pH value - Polarization tests - SO4^2-

Classification code: 512.1.1 Oil Fields - 522 Gas Fuels - 539.1 Metals Corrosion - 545.3 Steel - 701.1 Electricity: Basic Concepts and Phenomena - 801 Chemistry - 801.1 Chemistry, General - 803 Chemical Agents and Basic Industrial Chemicals - 804.2 Inorganic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.07.014

Database: Compendex

181.

Accession number: 20193207284585

Title: **A preliminary discussion on the reutilization of flue gas waste heat from gas field boosters for power generation**

Authors: Zhao, Liang ; Lei, Yu ; Du, Defei ; He, Li ; Yang, Haihong ; Wen, Chang ; Yu, Dunxi

Author affiliation: Institute of Safety, Environmental Protection and Technical Supervision, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610041, China

Safety & Environment Technology Research Institute, National Energy R&D Center of High-Sulfur Gas Reservoir Exploitation, Chengdu; Sichuan; 610041, China

State Key Laboratory of Coal Combustion, Huazhong University of Sciences and Technology, Wuhan; Hubei; 430074, China

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Abbreviated source title: Natur. Gas Ind.

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 25

Main heading: Energy efficiency

Controlled terms: Economics - Energy utilization - Exergy - Flue gases - Flues - Gases - Heat transfer - Investments - Power generation - Quality control - Rankine cycle - Waste heat - Waste heat utilization

Uncontrolled terms: Condensing temperature - Energy utilization efficiency - Evaporation pressure - Flue gas temperatures - Gas field development - Organic Rankine Cycle(ORC) - Organic Rankine cycles - Re-utilization

Classification code: 451.1 Air Pollution Sources - 525 Energy Management and Conversion - 641.1 Thermodynamics - 641.2 Heat Transfer - 913.3 Quality Assurance and Control - 971 Social Sciences

Numerical data indexing: Age 3.00e+00yr to 6.50e+00yr, Age 3.20e+00yr to 3.80e+00yr, Percentage 1.00e+01%, Percentage 3.00e+01%, Percentage 3.30e+01%, Percentage 3.48e+01%, Power 1.00e+04W to 8.00e+04W, Power 3.42e+05W, Power 6.67e+04W to 8.20e+04W

DOI: 10.3787/j.issn.1000-0976.2019.04.013

Database: Compendex

182.

Accession number: 20193607404722

Title: **An multi-objective optimal allocation model for regional natural gas consumption structure: A case study of Beijing**

Authors: Yan, Qingyou ; Qin, Chao

Author affiliation: Beijing Key Laboratory of New Energy Power and Low-Carbon Development Research, North China Electric Power University, Beijing; 102206, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 156-164

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 25

Main heading: Natural gas vehicles

Controlled terms: Automobiles - Commercial vehicles - Electric power transmission networks - Gas industry - Gas supply - Gases - Heating - Housing - Multiobjective optimization - Particle swarm optimization (PSO) - Site selection - Structural optimization - Wind power

Uncontrolled terms: Natural gas consumption - Optimal allocation - Particle swarm optimization algorithm - Power turbines - Six districts in Beijing - Utility theory - Wind power accommodations - Winter

Classification code: 403.1 Urban Planning and Development - 522 Gas Fuels - 615.8 Wind Power (Before 1993, use code 611) - 662.1 Automobiles - 706.1.1 Electric Power Transmission - 921.5 Optimization Techniques

DOI: 10.3787/j.issn.1000-0976.2019.06.018

Database: Compendex

183.

Accession number: 20193607404660

Title: **Research progress and prospect of numerical modeling for acid fracturing of heterogeneous carbonate reservoirs**

Authors: Gou, Bo ; Ma, Huiyun ; Liu, Zhuang ; Zhou, Changlin ; Wang, Kun

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Post-doctoral Research Center, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Engineering and Technology Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610031, China

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Pages: 87-98
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency
Number of references: 61
Main heading: Fracture
Controlled terms: Carbonation - Computer simulation - Etching - Hydraulic fracturing - Numerical models - Petroleum reservoir engineering - Petroleum reservoirs
Uncontrolled terms: Acid fracturing - Carbonate rock - Development trends - Heterogeneous - Oil and gas reservoir
Classification code: 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 723.5 Computer Applications - 802.2 Chemical Reactions - 921 Mathematics - 951 Materials Science
DOI: 10.3787/j.issn.1000-0976.2019.06.010
Database: Compendex

184.

Accession number: 20200208027897

Title: **Research progress in chemical methods for conditioning and destabilizing high water-content oily sludge**

Title of translation: **化学法调质脱稳高含水油泥技术研究进展**

Authors: Tong, Kun ; Xie, Jiacai ; Xie, Shuixiang ; Ren, Wen ; Liu, Xiaohui ; Zhang, Mingdong

Author affiliation: State Key Laboratory of Petroleum Pollution Control, Beijing; 102206, China

CNPC Research Institute of Safety & Environmental Technology, Beijing; 102206, China

Source title: Natural Gas Industry
Abbreviated source title: Natur. Gas Ind.

Volume: 39
Issue: 12
Issue date: December 25, 2019
Publication year: 2019
Pages: 155-160
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency
Number of references: 44
Main heading: Chemicals removal (water treatment)
Controlled terms: Convergence of numerical methods - Dewatering - Electrolytes - Emulsification - Flocculation - Physicochemical properties - Sludge disposal - Surface active agents - Wastewater disposal - Wastewater treatment
Uncontrolled terms: Dewatering effect - Emulsification systems - High water content - Inorganic matters - Oily sludges - Specific resistances - Technical principle - Treatment and disposal
Classification code: 452.2 Sewage Treatment - 452.4 Industrial Wastes Treatment and Disposal - 802.3 Chemical Operations - 803 Chemical Agents and Basic Industrial Chemicals - 921.6 Numerical Methods
DOI: 10.3787/j.issn.1000-0976.2019.12.020
Database: Compendex

185.

Accession number: 20192206992455

Title: **Type and genesis of Pre-Tertiary deep buried hills in the Bohai Sea area**

Title of translation: **渤海海域前古近系深层潜山类型及其成因**

Authors: Xu, Changgui ; Hou, Mingcai ; Wang, Yuechuan ; Chen, Anqing ; Huang, Zhifa ; Luo, Xiaoping ; Han, Jianhui ; Xu, Yunlong

Author affiliation: Tianjin Branch Company of CNOOC, Tianjin; 300452, China
Institute of Sedimentary Geology, Chengdu University of Technology, Chengdu; Sichuan; 610059, China
State Key Laboratory of Oil & Gas Reservoir Geology and

Exploitation, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

College of Energy, Chengdu University of Technology, Chengdu; Sichuan; 610059, China

Corresponding author: Hou, Mingcai (houmc@cdut.edu.cn)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Issue date: January 25, 2019

Publication year: 2019

Pages: 21-32

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The discovery of Jinzhou South Buried-Hill Oilfield and BZ19-6 Buried-Hill Gasfield reveals the immense oil and gas exploration potential of deep buried hills in the Bohai Sea area. In this area, however, complex and diverse buried hill structures lead to multiple classification schemes of buried hills, restricting the understanding on buried hill types and hydrocarbon accumulation rules in the Bohai Sea area. In this paper, the regional geological setting was analyzed. Then, based on the drilling and 3D seismic data in the Bohai Sea area, the stratigraphic structure and fault distribution characteristics of the buried hills in this area were studied, and the structural characteristics and evolutionary mechanical mechanisms of the buried hills were clarified. Finally, the buried-hill classification scheme was discussed, and the oil and gas exploration potential of buried hill belts was evaluated. And the following research results were obtained. First, the tectonic movements since Mesozoic lay a foundation for the development of the buried hill structures, the Yanshan Movement During Jurassic- Cretaceous dominates the formation of the internal structural style and external morphology of the buried hills, and the late fault-depression strike-slip activity since Cenozoic has a strengthening and shaping effect on the buried hills. Second, the Pre-Tertiary structural layer in the Bohai Sea area can be divided into Archeozoic-Proterozoic, Paleozoic and Mesozoic structural layers. Third, the buried hill structures can be divided into five patterns, i.e., compressional fold, extensional fault, strike-slip,

inversion and diapir. Fourth, the buried hills in the Bohai Sea area present the complex characteristics of multi-genesis, multi-structure, multi-lithology and multi-morphology. And according to the classification principle of genesis and structure, the buried hills in the Bohai Sea area are divided into 2 types and 7 sub-types, among which the eroded residual mound type buried hill and the tensile barrier type buried hill are better in the prospects of oil and gas exploration. It is concluded that PL7-1 Mesozoic buried hill in Bozhong low uplift and SZ36-1 buried hill in Liaoxi uplift have better prospects of oil and gas exploration, and the southern end of Liaoxi uplift, the western edge of Shaleitian uplift-Qikou sag in the west of Bohai Sea area and the gentle slope belt in the southwest of Bozhong sag are favorable areas for hydrocarbon accumulation of buried hill.

Number of references: 38

Main heading: Petroleum prospecting

Controlled terms: Fault slips - Gases - Geological surveys - Hydrocarbons - Lithology - Morphology - Offshore gas fields - Seismology - Stratigraphy - Strike-slip faults - Structural analysis

Uncontrolled terms: Bohai Bay Basin - Bohai Sea - Buried hill - Fault distribution - Genetic classification - Oil and gas exploration - Structural layers

Classification code: 408.1 Structural Design, General - 481.1 Geology - 484.1 Earthquake Measurements and Analysis - 512.1.2 Petroleum Deposits : Development Operations - 512.2.1 Natural Gas Fields - 804.1 Organic Compounds - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.01.003

Database: Compendex

186.

Accession number: 20192607089030

Title: **Fine characterization and target window optimization of high-quality shale gas reservoirs in the Weiyuan area, Sichuan Basin**

Title of translation: **四川盆地威远地区页岩气优质储层精细刻画与靶窗优选**

Authors: Wu, Hengzhi ; Xiong, Liang ; Ge, Zhongwei ; Shi, Hongliang ; Wang, Tong ; Fan, Li

Author affiliation: Sinopec International Petroleum Exploration and Production Corporation, Beijing; 100029, China

Southwest Branch, Sinopec Petroleum Exploration and

Production Research Institute, Chengdu; Sichuan; 610041, China

Chuanxi Drilling Company, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

Corresponding author: Ge, Zhongwei (gezhongwei.xnyq@sinopec.com)

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Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 11-20

Language: Chinese

ISSN: 10000976

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Sinopec's Weiyuan Shale Gas Block is structurally located at the Baimazhen syncline held by the Weiyuan paleo-uplift and Ziliujing anticline in the Sichuan Basin. In this block, the Wufeng Fm of Upper Ordovician-Longmaxi Fm of Lower Silurian is an organic-rich dark shale deposit of deep-water shelf facies, whose litho-electric characteristics of geophysical logging are obviously different vertically and reservoir heterogeneity is strong. For providing a guidance for target window optimization and drilling trajectory tracking and adjustment of horizontal wells in the Weiyuan Shale Gas Block, parameter indexes were evaluated by refining the reservoir classification based on well logging subdivision, fine characterization of core laminae, high-precision geophysical prediction and genetic analysis of sedimentary microfacies. Furthermore, the "sweet spots" of shale gas reservoirs were predicted. Then, the target window was optimized and the trajectory of a horizontal well was designed. Finally, the effects of the target window of a horizontal well on shale gas productivity were evaluated. And the following research results were obtained. First, three types of laminae are developed in the high-quality shale reservoir at the bottom of Wufeng Fm-Long 1 Member, and they are vertically staggered and overlapped, which reflects the microscopic difference of sedimentary environment and reservoir quality. Second, shale gas reservoirs in this block can be divided into high-quality reservoirs, better reservoirs, general reservoirs and poor reservoirs. Third, the sublayer 2-3 at the bottom of Longmaxi Fm

is biogenic sedimentary microfacies and it has the characteristics of "geological + engineering" sweet spot, e.g. high TOC contents, high porosity, high brittleness, high gas content and low in-situ stress difference, so it is classified as a high-quality reservoir. Fourth, actual drilling results show that the location selection of the target window of a horizontal well has a significant impact on single-well shale gas productivity, and the penetration rate of a high-quality reservoir is the key geological factor to achieve high-yield shale gas. The research results provide support for the evaluation of shale gas productivity and lay a foundation for the commercial development of shale gas in the Weiyuan Shale Gas Block.

Number of references: 18

Main heading: Petroleum refining

Controlled terms: Core analysis - Deposition - Fracture mechanics - Gas industry - Gases - Geophysics - Horizontal wells - Infill drilling - Offshore gas fields - Petroleum reservoirs - Productivity - Sedimentology - Shale gas - Well logging

Uncontrolled terms: Biogenetic - Deepwater - High quality reservoir - Laminae - Production capacity - Rate of penetration - Sichuan Basin - Sweet spot - Weiyuan Shale Gas Block

Classification code: 481 Geology and Geophysics - 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 512.2.1 Natural Gas Fields - 513.1 Petroleum Refining, General - 522 Gas Fuels - 802.3 Chemical Operations - 931.1 Mechanics

DOI: 10.3787/j.issn.1000-0976.2019.03.002

Database: Compendex

187.

Accession number: 20192206992454

Title: **The breakthrough of the deep-buried gas exploration in the Bohai Sea area and its enlightenment**

Title of translation: **渤海海域深层天然气勘探的突破与启示**

Authors: Xue, Yong'an

Author affiliation: Tianjin Branch, CNOOC China Limited, Tianjin; 300459, China

Corresponding author: Xue, Yong'an (xueya@cnooc.com.cn)

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Abbreviated Natur. Gas Ind.

source title:
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Publication year: 2019
Pages: 11-20
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency

Abstract: It is generally thought that the Bohai Bay Basin belongs to a typical oil-type basin in the eastern China, where, for lack of gas reserves, giant gas fields will be difficult to be formed, however, the latest discovery of the Bozhong 19-6 deep gas field shows a great potential of natural gas resources in the deep strata of the Bozhong Sag. In order to give some guidance for deep-strata gas exploration in the Bohai Bay Basin and other areas, we discussed the accumulation modes, controlling factors and enrichment laws in this study area. The following findings were achieved. (1) Thick humic-sapropelic source rocks buried deep in the Tazhong Sag have the characteristics of gas enrichment in high maturation stage under deep burial and the material conditions of forming large-scale gas fields. (2) The combined main forces of rock types, stress transformation and fluid dissolution controlled the giant-scale formation of the deep-buried clastic rocks and metamorphic rocks, which provides favorable reservoir conditions for the formation of large-scale gas fields. (3) The regional caprocks of thick-deposited and overpressured mudstones in the Tazhong Sag provide sealing and preservation conditions for large-scale natural gas pools. (4) A large-scale gas field intrusive accumulation model was proposed to explain that gas accumulated later than oil in the Bozhong Sag, characterized by abundant gas supply, late-stage fast accumulation and insider migration. In conclusion, such a breakthrough made in gas exploration in this study area is attributed to the long-term strategic deployment of "Discovering Large-scale Gas Fields in Oil-type Basins" and the opening up of thoughts, fine research, model innovation and technological progress.

Number of references: 27
Main heading: Oil field equipment
Controlled terms: Energy resources - Gases - Geological surveys -

Metamorphic rocks - Natural gas - Offshore gas fields - Petroleum deposits - Proven reserves

Uncontrolled terms: Archean - Bohai Bay Basin - Bohai Sea - Bozhong Sag - Glutenite - Paleogene

Classification code: 481.1 Geology - 511.2 Oil Field Equipment - 512 Petroleum and Related Deposits - 522 Gas Fuels - 525.1 Energy Resources and Renewable Energy Issues

DOI: 10.3787/j.issn.1000-0976.2019.01.002

Database: Compendex

188.

Accession number: 20192607089045

Title: **Research of umbrella-like tool for solid fluidization exploitation of shallow non-diagenetic gas hydrates in deep water**

Title of translation: **适用于深水浅层非成岩天然气水合物固态流化开采的伞式工具**

Authors: Song, Zhen ; Sun, Ying ; Li, Kaili ; Lü, Zhonglei ; Sun, Haoming

Author affiliation: School of Mechatronic Engineering, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

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Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 133-139

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Existing gas hydrate exploitation tools are not applicable in large-scale and large-range mining, so exploitation efficiency and economic performance are affected. In view of this, an umbrella-like tool which is used for crushing and collecting gas hydrates was designed and developed based on the exploitation ideas and process characteristics of solid fluidization method. Then, a three-dimensional structure model for the umbrella-like

tool was built according to working conditions, and the steady-state mechanical simulation and analysis was carried out. Finally, the exploitation effects were predicted. And the following research results were obtained. First, the whole umbrella-like tool does not lose its stability in the working state. The maximum stress is located at the joint between the arm and the outer-pipe rod, where the stress is lower than the yield strength of the given material, and the stresses at the rest parts of the tool are also below the limit yield strength of the given material. Second, when the arm of the tool is laterally deviated, structural deformation may occur and affect the actual exploiting range, but will not affect the rotary crushing on hydrates. Third, during the power transfer of exploitation torque, the maximum equivalent stress value of the drill pipe is less than the torsional strength of the pipe material. The whole drill pipe has no distortion but only a negligible displacement is generated. Fourth, when the umbrella-like tool is used for gas hydrate exploitation, the daily production can meet the economic requirements, and it has the potential of exploiting gas hydrates commercially.

Number of references: 16

Main heading: Gas hydrates

Controlled terms: Crushing - Design - Drill pipe - Drills - Economic analysis - Energy transfer - Fluidization - Gas industry - Gases - Hydration - Infill drilling - Strength of materials - Yield stress

Uncontrolled terms: Economic feasibilities - Economic requirements - Mechanical simulations - Process characteristics - Steady state - Structural deformation - Structural mechanics analysis - Three dimensional structure modeling

Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 522 Gas Fuels - 603.2 Machine Tool Accessories - 802.3 Chemical Operations - 911.2 Industrial Economics - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.03.017

Database: Compendex

189.

Accession number: 20192206992464

Title: **Well killing and plugging technology under the coexistence of blowout and circulation loss: A case study on Well Longtan 1 in the Jiulongshan structure, Sichuan Basin**

Title of translation: 喷漏同存条件下堵漏压井技术-以四川盆地九龙山构造龙探1井为例

Authors: Wang, Jun ; Fan, Xiangyu ; He, Liqin ; Sun, Yueming

Author affiliation: Petroleum Engineering School, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Chuanxi Drilling Company, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

Corresponding author: Fan, Xiangyu (93334271@qq.com)

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Pages: 106-112

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Due to the restriction of the casing program, Well Longtan 1 is faced with the following problems in the drilling of the ultra-high pressure gas reservoir of Permian Qixia Fm in the deep area of Jiulongshan structure of the Sichuan Basin. The complex pressure profile of high temperature and ultra-high pressure occurs in the same open hole section. Overflow happens when the Ø190.5 mm borehole drills into Qixia Fm. And blowout in the lower part and circulation loss in the upper part is induced with the increase of pressure control circulation. In this situation, the key to the successful completion of Well Longtan 1 is to deal with these difficulties. In this paper, the complex coexistence of blowout and circulation loss in Well Longtan 1 was analyzed and the difficulties related to treatment technologies were researched. Then, the technical idea of separating the upper thief zone from the lower high-pressure gas reservoir and increasing the bearing capacity of the thief zone to satisfy the drilling fluid density required by balanced drilling was figured out. In addition, the specific treatment measures of GZD rigid particles + walnut shells + HHH plugging formula were worked out as follows. First, drive the gas-contaminated drilling fluid back into the thief zone by impelling the kill fluid forward and backward so as to reduce the shut-in wellhead pressure. And

then inject the cement by using the isolation method to plug blowout layer and thief zone and stop the downhole internal circulation. Second, the time for wellhead pressure rising and the injection amount of plugging slurry in the process of plugging are used to predict the approximate location of the thief zone and estimate the characteristics of the thief zone, e.g. the size of the leak channel and the absorption capacity of the thief zone to plugging slurry, so as to provide a basis for adjusting the size, concentration and usage of plugging slurry in the subsequent operations. With these measures, the bearing capacity of Well Longtan 1 in Feixianguan Fm was successfully increased to 2.35 g/cm, and Qixia Fm was smoothly drilled and cementing was conducted by using the Ø168 mm casing. In conclusion, this appropriate plugging formula can effectively enlarge the safe density window of drilling fluid and provide useful experience for dealing with similar problems in this block and other areas.

Number of references: 19

Main heading: Wellheads

Controlled terms: Bearing capacity - Blowouts - Drilling fluids - Infill drilling - Petroleum reservoirs - Well pressure

Uncontrolled terms: Circulation loss - Hang's mudding-off technique - Internal circulations - Jiulongshan - Pressure system - Sichuan Basin - Well killing

Classification code: 511.1 Oil Field Production Operations - 512.1.1 Oil Fields - 914.1 Accidents and Accident Prevention

Numerical data indexing: Mass_Density 2.35e+03kg/m3

DOI: 10.3787/j.issn.1000-0976.2019.01.012

Database: Compendex

190.

Accession number: 20194807753697

Title: **Control of the Mesozoic tectonic movement on the hydrocarbon generation and evolution of Upper Paleozoic coal-measure source rocks in the Huanghua Depression, Bohai Bay Basin**

Title of translation: **黄骅坳陷中生代构造运动对上古生界煤系烃源岩生烃演化的控制**

Authors: Zhang, Jinning ; Zhou, Jiansheng ; Xiao, Dunqing ; Han, Guomeng ; Zhao, Min ; Fu, Lixin ; Li, Hongjun ; Lou, Da

Author affiliation: PetroChina Dagang Oilfield Company, Tianjin; 300280, China

PetroChina Research Institute of Petroleum Exploration & Development, Beijing; 100083, China

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Pages: 1-10

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Recently, great discoveries have been made on the primary gas reservoirs related to the Upper Paleozoic coal measure in the inner buried hills of Gangbei, Wumaying and Qibei in the Huanghua Depression of the Bohai Bay Basin, which reveals a huge oil and gas resource potential in this depression. In order to deepen the understanding of the controlling factors of the Mesozoic tectonic movement in the Huanghua Depression on the hydrocarbon generation of Upper Paleozoic coal-measure source rocks, we analyzed the Mesozoic tectonic system and evolution, the basin migration process and the geochemical characteristics and hydrocarbon generation history of coal-measure source rocks by means of structural analysis, burial-thermal history analysis, core slice observation and basin hydrocarbon generation simulation. In addition, the influences of the subsidence, migration and magmatic activity of Mesozoic basins on the hydrocarbon generation of coal-measure source rocks were studied. And the following research results were obtained. First, in the Huanghua Depression, there were multi-stage and multi-type tectonic movements in the Mesozoic, and the main tectonic events include Triassic craton uplift-subsidence movement, Jurassic differential depression-compression-torsion movement, Cretaceous volcanic activity and extensional uplift movement. Second, the basin migration process is from south to north, and the Kongdian uplift is an important boundary of South and North migration. Third, the Upper Paleozoic coal-measure source rocks in the Huanghua Depression experience two hydrocarbon generation processes, and there are early hydrocarbon reservoirs. Fourth, the Upper Paleozoic coal measure in the Cangdong Sag reached the effective hydrocarbon generation threshold at the end of Late

Jurassic, and the Upper Paleozoic coal-measure source rocks in the Qikou Sag reached the hydrocarbon generation threshold at the end of Early Cretaceous. Fifth, the control of the Mesozoic tectonic movement on the primary hydrocarbon generation and evolution of source rocks is mainly embodied in two aspects. On the one hand, basin migration events in the Mesozoic dominate the primary hydrocarbon generation sequence of source rocks. And on the other hand, local heating events of magmatic rocks accelerate the hydrocarbon generation and abnormal maturation of organic matter in source rocks. In conclusion, the research results define the control factors of the Mesozoic tectonic movement on the primary hydrocarbon generation and evolution of Upper Paleozoic coal-measure source rocks, and can be used as reference for researching the Mesozoic tectonic movement and the hydrocarbon generation and evolution of coal measure, restoring the protobasins and conducting oil and gas exploration in North China.

Number of references: 49

Main heading: Petroleum prospecting

Controlled terms: Coal - Coal deposits - Hydrocarbons - Landforms - Metamorphic rocks - Petroleum reservoirs - Subsidence - Tectonics

Uncontrolled terms: Bohai Bay Basin - Huanghua Depression - Hydrocarbon generation - Late Paleozoic - Magmatic activity - Mesozoic - Source rocks - Tectonic movements

Classification code: 481.1 Geology - 483.1 Soils and Soil Mechanics - 503 Mines and Mining, Coal - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 524 Solid Fuels - 804.1 Organic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.09.001

Database: Compendex

191.

Accession number: 20193207285167

Title: **Recognitions on the flow mechanism of shale during the plug pulse decay measurement**

Authors: Yang, Yu ; Zhou, Wei ; Zhou, Wen ; Zhang, Hao ; Wu, Xiang

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation//Chengdu University of Technology, Chengdu; Sichuan; 610059, China

Australian School of Petroleum, Computer and Mathematical Sciences, University of Adelaide, Adelaide; SA; 5005, Australia

China United Coalbed Methane Co., Ltd., Beijing; 100011, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: When using the plug pulse decay method to measure shale permeability, a comprehensive analysis of various factors influencing the measurement and analysis precision is conducive to improving the accuracy of the test result. A great number of nano-scale pores are developed in shale, so the lower the test pressure is, the more easily the non-Darcy flow tends to emerge. In order to ensure the gas is in the form of Darcy flow in the process of measurement, we put forward the lower pressure limit of Darcy flow in pores according to the definition of Knudsen number. Then, the gas desorption-flow coupling model for the gas flow process during the plug pulse decay measurement was established by considering the effects of gas on the adsorption in organic pores. After the partial differential equation set was solved and derived, the corresponding permeability calculation method was proposed. Finally, after the plug pulse decay measurement, the supporting nitrogen isothermal adsorption test and methane isothermal adsorption test were conducted on shale samples. And the following research results were obtained. First, during the plug pulse decay measurement, the flow of gas in rock samples is one-dimensional linear, so when establishing the flow equation, the gas pseudo pressure can be replaced with the gas pressure to simplify the calculation. Second, the adsorption of nitrogen in shale is much less than that of methane in shale, so the influence of nitrogen desorption on the flow is negligible when the pressure difference (i.e.<5%) of upstream and downstream changes within 5% of the initial pore pressure. In conclusion, the available industrial standards don't take into consideration the influence of gas adsorption, but the shale permeability measurement can still satisfy the accuracy requirement.

Number of references: 16

Main heading: Shale

Controlled terms: Adsorption - Decay (organic) - Desorption - Flow of gases - Gas adsorption - Gases - Isotherms - Mathematical models - Mechanical permeability - Methane - Nanotechnology - Nitrogen - Testing

Uncontrolled terms: Comprehensive analysis - Darcy flows - Decay methods - Isothermal adsorption - Measurement and analysis - Permeability measurements - Pore diameters - Pulse decay measurements

Classification code: 631.1.2 Gas Dynamics - 761 Nanotechnology - 802.2 Chemical Reactions - 802.3 Chemical Operations - 804 Chemical Products Generally - 804.1 Organic Compounds

Numerical data indexing: Percentage 5.00e+00%

DOI: 10.3787/j.issn.1000-0976.2019.05.008

Database: Compendex

192.

Accession number: 20200408064777

Title: **Analysis of tight oil and gas charging characteristics by the carbon isotope field detection technology: A case study of the northern slope of the Minfeng sub-sag in the Bohai Bay Basin**

Title of translation: **碳同位素现场检测技术分析致密油气充注特征-以渤海湾盆地民丰洼陷北斜坡为例**

Authors: Ci, Xinghua ; Zhang, Huanxu ; Niu, Qiang ; Zhu, Di ; Kang, Shujuan ; Hu, Jian ; Zhang, Lisheng ; Zhang, Jiazheng ; He, Kun

Author affiliation: Geological Logging Company, Sinopec Shengli Oilfield Service Corporation, Dongying; Shandong; 257000, China

College of Engineering, Peking University, Beijing; 100083, China

Suzhou California Energy and Environment Research Institute, Suzhou; Jiangsu; 215004, China

Suzhou Grand Energy Technology LLC, Suzhou; Jiangsu; 215129, China

Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing; 100080, China

Oil and Gas Survey Centre, China Geological Survey, Beijing; 100080, China

PetroChina Research Institute of Petroleum Exploration and

Development, Beijing; 100083, China

Corresponding author: Zhang, Huanxu (huanxu_zhang@sina.com)

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Pages: 10-17

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Studying hydrocarbon charging is quite important for searching exploration targets and confirming well locations. In this paper, the north slope of the Minfeng sub-sag in the Bohai Bay Basin was taken as an example. The wells Yanxie 233, Yongxie 932 and Yan 22 were selected for on-site carbon isotope detection. Then, based on sufficient carbon isotope data which were acquired on the drilling site using the brand-new carbon isotopic measuring instrument, the carbon isotope data and composition data of natural gas produced in this area were compared. And combined with the evolution of source rocks, the geochemical characteristics of crude oil, the depositional environment of reservoirs and the physical properties, single-well charging characteristics and regional charging area of natural gas were analyzed. Finally, the feasibility of on-site carbon isotope detection method to discriminate hydrocarbon charging was discussed. And the following research results were obtained. First, deep hydrocarbon charging happened in the lower fourth Member of Shahejie Formation in Well Yanxie 233, and its natural gas is the mixture of the oil cracking gas of deep layers and the thermal cracking gas of autochthonous source rocks. Second, the natural gas in the third and fourth Members of Shahejie Formation in Well Yongxie 932 is the thermal cracking gas of autochthonous source rocks, but deep gas charging occurred in particular hole sections. Third, the carbon isotope of associated gas in Well block Yan 22 is high in the central area and low in both sides and high in the south and low in the north, which is accordant with the distribution characteristics of reservoir physical properties, indicating that the charging of high-maturity natural gas is under the control of reservoir

physical properties. Fourth, the oil in Well block Yan 22 is the product of autochthonous source rocks in the mature stage while the natural gas is the autochthonous oil-associated gas combined with the charging of deep high-maturity product. It is concluded that there is a high-maturity hydrocarbon charging area in the northwest of the northern slope of the Minfeng sub-sag, and it is a favorable hydrocarbon exploration target. What's more, the on-site carbon isotope rapid detection technology can provide a large number of continuous three-dimensional carbon isotope data, and it can be used to quickly analyze the characteristics of hydrocarbon charging and determine the source and origin of hydrocarbon, so as to provide reference for hydrocarbon development deployment.

Number of references: 23

Main heading: Petroleum prospecting

Controlled terms: Associated gas - Carbon - Cracking (chemical) - Crude oil - Electric charge - Exploratory geochemistry - Gases - Hydrocarbons - Isotopes - Natural gas wells - Oil wells - Physical properties - Rocks

Uncontrolled terms: Bohai Bay Basin - Carbon isotopes - Field detections - Gas sources - Minfeng sub-sag - Oil and gas

Classification code: 481.2 Geochemistry - 512 Petroleum and Related Deposits - 701.1 Electricity: Basic Concepts and Phenomena - 802.2 Chemical Reactions - 804 Chemical Products Generally - 804.1 Organic Compounds - 931.2 Physical Properties of Gases, Liquids and Solids

DOI: 10.3787/j.issn.1000-0976.2019.11.002

Database: Compendex

193.

Accession number: 20193907482182

Title: **Preservation mechanisms of intergranular pores in sandstone reservoirs**

Title of translation: **砂岩储集层粒间孔隙保存机制**

Authors: Zhang, Penghui ; Lee, Yong Il ; Zhang, Jinliang ; Liang, Jie ; Wu, Yingli ; Yuan, Yong ; Wang, Jinchen ; Liu, Luchen ; Wang, Zhengyun ; Fu, Junjie

Author affiliation: College of Oceanography, Hohai University, Nanjing; Jiangsu; 210098, China

Laboratory for Marine Mineral Resources, Pilot National

Laboratory for Marine Science and Technology(Qingdao), Qingdao; Shandong; 266071, China

School of Earth and Environmental Sciences, Seoul National University, Seoul; 08826, Korea, Republic of

School of Natural Resources, Beijing Normal University, Beijing; 100875, China

Qingdao Institute of Marine Geology, China Geological Survey, Qingdao; Shandong; 266071, China

Wuxi Research Institute of Petroleum Geology, Sinopec Exploration & Production Research Institute, Wuxi; Jiangsu; 214151, China

Sinopec Shanghai Offshore Oil & Gas Company, Shanghai; 200120, China

Shanghai Geophysical Exploration Branch, Sinopec Offshore Oil Engineering Co., Ltd., Shanghai; 200131, China

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Publication year: 2019

Pages: 31-40

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Studies on the preservation of pores in sandstone reservoirs under the conditions of great burial depth and high temperature are still in dispute in terms of preservation mechanisms, application conditions and experimental simulation. In order to better analyze the preservation mechanisms of intergranular pores in sandstone reservoirs, we reviewed domestic and foreign research achievements on the preservation of sandstone intergranular pores in recent years in this paper. Then, the effects on reservoir quality by grain coating development, pore fluid overpressure, heat flow disturbance related to foreign salt and hydrocarbon charging were described. Finally, the future research trend and direction on pore preservation mechanisms were pointed out. And the following research results were obtained. First, grain coating development can preserve intergranular pores by inhibiting quartz overgrowth. Chlorite coating is mainly developed in the sedimentary environments of

delta and fluvial facies. Reservoirs with coarser sandstones and higher grain surface coverage ratio of chlorite coating tend to be high-quality reservoirs, and its inhibition on quartz cementation is superior to illite coating. Micritic quartz coating exerts an inhibition effect on quartz overgrowth by combining the nano-scale thin layer of syngenetic amorphous silicon and chalcedony with the aggregate of micritic quartz. Second, pore fluid overpressure is a kind of important pore preservation mechanism for shallow sandstones through inhibiting compaction and pressolution. Third, the existence of foreign salt can inhibit the geotemperature, so as to reduce the amount of quartz overgrowth in sandstone reservoirs. And in the sandstones with thicker salt and early emplacement, more intergranular pores can be preserved easily. Fourth, the influence degree of hydrocarbon charging on pore preservation can be hardly evaluated quantitatively. In conclusion, the analysis and prediction on the factors influencing the preservation of intergranular pores in deep sandstone reservoirs are still in the stage of microscopic observation and experimental simulation, and the regional prediction and identification technologies shall be explored further. What's more, the simulation on the evolution of sandstone reservoir porosity based on the cognitions of pore preservation mechanisms is the research difficulty and emphasis in the future.

Number of references: 57

Main heading: Sandstone

Controlled terms: Amorphous silicon - Coatings - Hydrocarbons - Nanotechnology - Quartz - Sedimentology - Textures

Uncontrolled terms: Diagenesis - Intergranular pores - Pore fluids - Reservoir quality - Sandstone reservoirs

Classification code: 481.1 Geology - 482.2 Minerals - 549.3 Nonferrous Metals and Alloys excluding Alkali and Alkaline Earth Metals - 761 Nanotechnology - 804.1 Organic Compounds - 813.2 Coating Materials

DOI: 10.3787/j.issn.1000-0976.2019.07.004

Database: Compendex

194.

Accession number: 20194807752914

Title: **A low-pressure wet gas measurement method based on Venturi flowmeters and Gamma ray technology**

Title of **基于文丘里管和射线技术的低压湿气测量方法**

translation:

Authors: Zheng, Yongjian ; Wang, Zhengang ; Pan, Yanzhi ; Zhao, Yueqian

Author affiliation: CNOOC China Limited Zhanjiang Branch, Zhanjiang; Guangdong; 524000, China

Haimo Technologies Group Corp., Lanzhou; Gansu; 730010, China

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Publication year: 2019

Pages: 117-122

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: When the flow rate of wet gas is measured, overreading is common, which leads to inaccurate measurement. In order to solve this problem, this paper firstly analyzed the overreading mechanisms of wet gas measurement based on the principle of Venturi flow rate measurement. Then, a great number of tests were carried out on low-pressure wet gas measurement, and the calculation errors of existing empirical models were comparatively analyzed. On the basis of the gas-liquid fractional flow model, the void fraction was measured by means of the Gamma ray technology, and combined with the Venturi measurement result, the superficial liquid velocity was obtained. Finally, regression analysis was carried out, and a new model for correcting the overreading of wet gas flow rate was proposed. And the following research results were obtained. First, the main reason for the overreading of wet gas flow rate measured in Venturi tubes is that due to the existence of liquid phase, gas phase is blocked, which results in accelerated pressure drop and friction-drag pressure drop caused by the acceleration of gas phase to liquid phase. Second, the overreading of Venturi flow rate measurement is mainly related to the parameters that can characterize the liquid carrying rate, such as Lockhart-Martinelli (LM) parameter, superficial liquid velocity, void fraction and dryness fraction. Third, in practical application, LM parameter in existing models cannot be measured directly. Fourth, there is a stronger linear relation between the superficial liquid velocity

and the overreading of Venturi measurement. And the gas flow rate calculated based on this relation is the least in the root-mean-square (RMS) error. Fifth, beginning from the gas-liquid two-phase fractional flow model, the Venturi measurement and the void fraction measured by means of Gamma sensor can be used to calculate the superficial liquid velocity, so a new model for correcting the overreading of gas flow rate can be established. In conclusion, the gas flow rate measured in the newly established model has an RMS error of 5.1%, which can satisfy the requirements of actual measurement. The research results provide a new method for the engineering application of wet gas measurement.

Number of references: 21

Main heading: Flow rate

Controlled terms: Drops - Errors - Flow of gases - Gamma rays - Gas fuel measurement - Gases - Liquids - Pressure drop - Regression analysis - Two phase flow - Velocity - Void fraction

Uncontrolled terms: Dryness fraction - L-m parameters - Over readings - Superficial liquid velocity - Venturi - Wet gas

Classification code: 522 Gas Fuels - 631 Fluid Flow - 922.2 Mathematical Statistics - 931.3 Atomic and Molecular Physics - 951 Materials Science

Numerical data indexing: Percentage 5.10e+00%

DOI: 10.3787/j.issn.1000-0976.2019.09.015

Database: Compendex

195.

Accession number: 20194207561359

Title: **Distribution characteristics and hydrocarbon accumulation conditions of biogenic gas reservoirs all over the world**

Title of translation: **全球生物气藏分布特征及成藏条件**

Authors: Yang, Songling ; Zhang, Ke ; Chen, Jingyang ; Qiu, Chunguang ; Min, Caizheng

Author affiliation: CNOOC Research Institute Co., Ltd., Beijing; 100028, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019
Pages: 10-24
Language: Chinese
ISSN: 10000976
CODEN: TIGOE3
Document type: Journal article (JA)
Publisher: Natural Gas Industry Journal Agency

Abstract: In order to clarify the future exploration direction of large-scale biogenic gas reservoirs, this paper reviewed the basic information of 18 global major development areas of biogenic gas reservoirs and the petroleum geological conditions of 14 development areas of primary conventional biogenic gas reservoirs of early biogenesis. Then, the distribution characteristics of primary biogenic gas reservoirs and their relationships with the hydrocarbon accumulation conditions were analyzed. Finally, the macroscopic geological conditions for the formation of large-scale primary biogenic gas reservoirs were summarized. And the following research results were obtained. First, the reserve distribution of biogenic gas reservoirs is characterized by young reservoir age, smaller burial depth and deep-water and ultradeep-water remnant ocean basin. Second, over 70% reserves of the primary conventional biogenic gas reservoirs of early biogenesis in the whole world are distributed in the sedimentary environments related to palaeodelta river mouth or submarine fan (especially large-scale deepwater fan) with low surface (sea floor) temperature and low geothermal gradient. Third, the thick sandstone-mudstone strata developed in these areas have a high sedimentation rate and a low sandstone/formation ratio. Therefore, the source rocks dominated by humic organic matter with a certain abundance (TOC>0.5%) are formed, and they can not only provide large space and nutrient for the microbe activity in the long period, but also inhibit the dispersion of biogenic gas. In conclusion, the future exploration direction of large-scale biogenic gas reservoirs focuses on the areas with the following four conditions, including a permafrost region and a deepwater zone with low surface (sea floor) temperatures, a basin with a low geothermal gradient, sedimentary environment related to palaeodelta river mouth-submarine fans and positive structure belts with moderate tectonic activity intensity. Specifically, exploration direction is as follows: (1) The deepwater zones at the outer belt of passive continental margin basin with large provenance, e.g. the deepwater of the Niger Delta Basin, Congo fan, Amazon fan and some palaeodelta development area at both sides of the South Atlantic; (2) The remnant ocean basins

with large submarine fan, e.g. Bengal fan and Indus fan; (3) The foredeep zones of foreland basin with the characteristics of deep foredeep, e.g. the eastern foredeep of Papuan Basin; (4) The sags inside the craton basins in those permafrost areas.

Number of references: 45

Main heading: Offshore petroleum prospecting

Controlled terms: Biosynthesis - Gases - Hydrocarbons - Offshore gas fields - Permafrost - Petroleum geology - Petroleum reservoir engineering - Petroleum reservoirs - Proven reserves - Sandstone - Sedimentology - Submarines

Uncontrolled terms: Biogenic gas - Distribution characteristics - Exploration direction - Global - Hydrocarbon accumulation

Classification code: 461.8 Biotechnology - 481.1 Geology - 482.2 Minerals - 512 Petroleum and Related Deposits - 672.1 Combat Naval Vessels - 804.1 Organic Compounds

Numerical data indexing: Percentage 7.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.08.002

Database: Compendex

196.

Accession number: 20200408064993

Title: **Some insights into the "New Policies" on unconventional natural gas subsidies**

Title of translation: **对于非常规天然气补贴"新政"的几点认识**

Authors: Zhang, Kang ; Yu, Yang

Author affiliation: Sinopec Exploration & Production Research Institute, Beijing; 100083, China

China Petrochem Journal, Beijing; 100029, China

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Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 126-131

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In June 2019, the Ministry of Finance issued the "Supplementary Notice on 'Provisional Measures on the Administration of Special Fund for the Development of Renewable Energy'", which is called the "New Policies" on unconventional natural gas subsidies in the energy industry and it arouses intensive concerns and discussions. In this paper, the "New Policies" was analyzed and illustrated. And the following characteristics were summarized. First, the subsidy period and scope of unconventional natural gas are increased. The subsidy period is extended to the year of 2023 and the subsidy scope is expanded from shale gas and coalbed methane to tight sandstone gas. Second, the subsidy object is the exploitation utilization volume, which is in accordance with the direction of market-oriented reform. And for tight gas, only the incremental of exploitation utilization volume compared with that in 2017 is taken into account. Third, different distribution coefficients are assigned on the basis of development difficulty, so the priority is highest for coalbed methane, then shale gas and lowest for tight sandstone gas. Fourth, reward is awarded for the increase and penalty is exerted for the reduction. The more the increase is, the more the subsidy is. Fifth, peak shaving in heating seasons shall be promoted. Sixth, the total subsidy is cut into several parts, and the supplementary reward is distributed afterwards. Then, the problems which may be faced during the implementation of the "New Policies" were analyzed further as follows. First, the difference between the wellhead production of natural gas and the commodity volume shall not be neglected. Second, the correct statistics on the commodity volume (utilization volume) of natural gas is related to the overall development situation and shall be solved in time. Third, practice is the only way to verify the promotion degree of financial subsidy to the development of unconventional gas. Fourth, it is necessary to increase the total subsidy of unconventional gas. In conclusion, the reward and subsidy policies on the production of unconventional oil and gas needs modifying and completing in the practice and the definite regulations or countermeasures shall be prepared before or during the implementation of the policies.

Number of references: 20

Main heading: Natural gas wells

Controlled terms: Coal bed methane - Coal deposits - Firedamp - Methane -

Natural gas - Sandstone - Shale gas - Tight gas - Wellheads

Uncontrolled terms: Commodity volume - Renewable energies - Reward and subsidy scheme - Total subsidy volume - Unconventional natural gas - Yield

Classification code: 482.2 Minerals - 503 Mines and Mining, Coal - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 804.1 Organic Compounds

DOI: 10.3787/j.issn.1000-0976.2019.11.017

Database: Compendex

197.

Accession number: 20193907482173

Title: **Hydrogen bond inhibition method: Reducing the adsorption damage of guar fracturing fluid to sandstone reservoirs**

Title of translation: **氢键抑制方法减少瓜尔胶压裂液对砂岩储层的吸附伤害**

Authors: Guo, Jianchun ; Li, Yang ; Wang, Shibin

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

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ISSN: 10000976

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to reduce the adsorption damage of guar fracturing fluid to porous sandstone media and relieve its damage to the permeability of tight sandstone reservoirs, we took the sandstones of the Shaximiao Fm, Middle Jurassic in the Sichuan Basin, as the research object in this paper. The adsorption capacity of guar gum on the sandstone surface was determined by conducting thermogravimetric experiments. Then, the

adsorption mechanisms of guar fracturing fluid in porous sandstone media were analyzed using X-ray photoelectron spectroscopy test combined with the core flow experiment. Finally, the change of sandstone pore throat structure caused by the adsorption of fracturing fluid and the effect of hydrogen bond inhibitor on the comprehensive performance of fracturing fluid were studied by means of nuclear magnetic resonance and CT image. And the following research results were obtained. First, fracturing fluid can be adsorbed inside porous rock media, leading to the reduction of rock pore size and the deterioration of reservoir permeability, and its adsorption capacity is about 3.9 mg/g. Second, the multiple hydrogen bonds composed of oxygen groups and guar molecules on the sandstone surface are the main action for the adsorption between porous sandstone media and fracturing fluid, so hydrogen bond inhibitor can reduce the adsorption capacity of guar gum in sandstones and decrease its damage degree to reservoir permeability. Third, the addition of hydrogen bond inhibitor has little effect on the rheological properties of fracturing fluid, but it can greatly reduce the surface tension and residual content of gel breaking fluid. In conclusion, hydrogen bond inhibitor can eliminate the adsorption between guar gum and sandstones and effectively decrease the damage of guar fracturing fluid to reservoirs without any effect on the comprehensive performance of fracturing fluid. The research results are of great significance to understanding the performance of hydrogen bond inhibitor, improving guar fracturing fluid system, and promoting the stimulation effects of tight sandstone reservoirs.

Number of references: 31

Main heading: Hydrogen bonds

Controlled terms: Adsorption - Computerized tomography - Desorption - Deterioration - Fracturing fluids - Hydraulic fracturing - Mechanical permeability - Petroleum reservoir engineering - Pore size - Rheology - Sandstone - Tight gas - X ray photoelectron spectroscopy

Uncontrolled terms: Adsorption mechanism - Guar gums - Reservoir damage - Rheological property - Tight sandstones

Classification code: 482.2 Minerals - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 723.5 Computer Applications - 801.4 Physical Chemistry - 802.3 Chemical Operations - 931.1 Mechanics - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.07.007

Database: Compendex

198.

Accession number: 20200408064891

Title: **Integrated prediction on the distribution of reef beach in the depositional environment of low-energy deepwater slopes in the Amu Darya Right Bank Block**

Title of translation: **阿姆河右岸区块深水低能缓坡礁滩分布综合预测**

Authors: Li, Xianghua ; Zhang, Ting ; Li, Hongxi

Author affiliation: Geologic Exploration and Development Research Institute, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The Beschkent Depression in the Amu Darya Right Bank Block of Turkmenistan has a special depositional environment of low-energy deepwater gentle slopes where the geological understanding has been so little known currently that natural gas exploration there is quite difficult. In order to speed up the natural gas exploration in the Beschkent Depression, this paper analyzed the depositional characteristics of Callovian and Oxfordian of Middle-Upper Jurassic and the basal palaeogeomorphology. Then, from the perspective of geophysics, the characteristic investigation and seismic identification of reef beach in the depositional environment of low-energy deepwater slopes were carried out by means of reef-beach body thickness identification, discontinuous seismic attribution extraction and forward modeling based on wave equation, and accordingly the distribution of reef beach was confirmed. Finally, an integrated seismic and geologic identification method suitable for the Beschkent Depression was developed. And the following research results were obtained. First, in the Beschkent Depression, the rock types of Callovian-

Oxfordian stage are mainly micrite grainstone, grain micrite and micrite. The depositional environment is mainly middle-outward gentle slope facies in the Callovian stage, and upper-lower slope facies in the Oxfordian stage, presenting obvious depositional characteristics of low-energy gentle slope. Second, three sub-palaeouplifts are developed in the basal palaeogeomorphology of the Beschkent Depression and the palaeogeomorphologic characteristics of being high in the northwest and low in the southeast are presented, which lays a geomorphologic foundation for the development of reef beach in the later stage. Third, based on 3D seismic data, 68 reef-beach bodies larger than 1 km are identified in the study area, with a total area of 187.3 km. The northern and central-southern parts of the Beschkent Depression are the favorable zones for the development of reef beach. Fourth, it is revealed from the integrated geologic and seismic interpretation that Well block G22 and T21 in the northern part of Beschkent Depression and Well block B21-H21 in the central-southern part and its periphery zone are favorable zones. Two wells deployed and drilled in the favorable zones produce high-yield gas flow. In conclusion, this proposed integrated seismic and geologic identification method for subsalt small-scale reef beach in the depositional environment of deepwater gentle slope presents remarkable application effects. It promotes the significant breakthrough in the exploration of carbonate gas reservoirs in the Beschkent Depression and also provides some reference for the exploration of similar gas reservoirs.

Number of references: 18

Main heading: Subsalt strata

Controlled terms: Beaches - Deposition - Flow of gases - Gases - Geological surveys - Natural gas - Offshore gas fields - Offshore petroleum prospecting - Petroleum reservoirs - Reefs - Seismology

Uncontrolled terms: Amu Darya right bank - Depositional characteristics - Depositional environment - Gentle slopes - Natural gas exploration - Seismic interpretation - Sub salts - Turkmenistan

Classification code: 407.3 Coastal Engineering - 481.1 Geology - 484.1 Earthquake Measurements and Analysis - 512 Petroleum and Related Deposits - 522 Gas Fuels - 631.1.2 Gas Dynamics - 802.3 Chemical Operations

Numerical data indexing: Area 1.00e+06m2, Area 1.87e+08m2

DOI: 10.3787/j.issn.1000-0976.2019.11.001

Database: Compendex

199.

Accession number: 20200408064780

Title: **Design and application of well cementing technology based on the precise managed pressure balancing method in narrow pressure window hole sections**

Title of translation: **窄压力窗口井段精细控压压力平衡法固井设计方法与应用**

Authors: Guo, Jianhua ; Zheng, Youcheng ; Li, Wei ; Li, Bin ; Yuan, Bin ; Xu, Bihua

Author affiliation: Engineering Technology Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610017, China

PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610051, China

State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In the Sichuan Basin, the drilling of complex deep and ultradeep wells is restricted by the casing sequence. Multiple pressure systems are usually encountered in the same open hole section, and narrow safety density window is observed in vertical strata. The application of managed pressure drilling (MPD) technique which is often used in well drilling ensures the safe and efficient drilling, but it also brings about great challenges to the small-gap liner cementing at the lower part. Therefore, it is of great practical significance to research a cementing technology that can not only satisfy the quality requirement of small-gas liner

cementing, but also ensure the safe cementing in the strata with narrow safety density window. In this paper, a cementing technology based on precise managed pressure balancing method was proposed by referring to the successful application of MPD technique. According to the cementing design, the hydrostatic column pressure of annulus fluid is underbalanced (slightly lower than the formation pore pressure), and then a precise managed pressure drilling device is adopted to produce back pressure through wellhead restriction or apply wellhead compensation pressure, so that the balanced pore pressure can be reached in the process of cementing via the wellhead pressure and the flow friction of fluid in the annulus. After the cementing is completed, a certain compensation pressure is applied to the annulus continuously to prevent annulus channeling during waiting on cement caused by insufficient static pressure and slurry weight loss. After this technology was applied to an ultradeep exploration well in the Sichuan Basin, the qualification rate of borehole cementing quality reached 97%, and the well sections with good cementing quality accounted for 76%. In conclusion, this technology needs no additional equipment, and only by virtue of the MPD equipment, it can achieve safe cementing construction and cementing quality improvement under high displacement efficiency.

Number of references: 17

Main heading: Well drilling

Controlled terms: Cementing (shafts) - Construction equipment - Exploratory boreholes - Infill drilling - Petroleum prospecting - Pore pressure - Well cementing - Wellheads

Uncontrolled terms: Liner - Lost circulation - Pressure balancing - Sichuan Basin - Well cementation

Classification code: 405.1 Construction Equipment - 483.1 Soils and Soil Mechanics - 511.1 Oil Field Production Operations - 512.1.2 Petroleum Deposits : Development Operations

Numerical data indexing: Percentage 7.60e+01%, Percentage 9.70e+01%

DOI: 10.3787/j.issn.1000-0976.2019.11.011

Database: Compendex

200.

Accession number: 20194207561132

Title: **Wellbore cleaning technologies for shale-gas horizontal wells: Difficulties and countermeasures**

Title of translation: 页岩气水平井井筒清洁技术的难点及对策

Authors: Zhang, Huali ; Yang, Sheng ; Liu, Dongming ; Li, Yufei ; Luo, Wei ; Li, Junwu

Author affiliation: Engineering Technology Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610017, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 8

Issue date: August 25, 2019

Publication year: 2019

Pages: 82-87

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Applying horizontal well drilling and large-scale sand fracturing in shale gas reservoirs can increase production, but the problem of gas wellbore blockage occurs frequently. How to remove the residual bridge plug debris and sand in plug drilling operation and ensure that the downhole production channel of a shale gas well is unblocked is important in the safe production of the shale gas well. In this paper, the current situations of the wellbore cleaning technology for horizontal wells were analyzed, and the technical difficulties in the wellbore cleaning treatment of shale gas horizontal wells were summarized. Then, based on the development of wellbore cleaning technologies for horizontal wells all over the world, technical researches were carried out on the cleaning tools and technologies and the working fluid performance, and cleaning treatment tools were researched and developed. Finally, the technical countermeasures of cleaning treatment were put forward and their field application effects were analyzed. And the following research results were obtained. First, the milling-fishing integrated tool developed to treat large-diameter bridge plug can realize the washover and fishing of large-diameter bridge plug by one trip after running in the hole. Second, when the reverse cyclone sand-washing tool is applied in long horizontal sections, it can prevent sand from settling so as to reach the target of flushing sand out of wellbore. Third, for normal pressure and high pressure wells, gas well backflow fluid,

KCl and CaCl2 solution can be used as working fluid, while for low pressure wells, foam fluid can be used. Fourth, for low pressure wells, the negative pressure fishing tool was designed and optimized to drive debris or sediment into the tool by forming local negative pressure adsorption, so as to complete the fishing operation. In conclusion, this new wellbore cleaning technology suitable for shale-gas horizontal wells lays a foundation for large-scale wellbore cleaning treatment of shale gas wells.

Number of references: 22

Main heading: Oil field equipment

Controlled terms: Boreholes - Chlorine compounds - Cleaning - Debris - Fishing (oil wells) - Gases - Horizontal drilling - Horizontal wells - Infill drilling - Milling (machining) - Natural gas well production - Natural gas wells - Petroleum reservoirs - Potassium compounds - Sand - Shale gas - Storms

Uncontrolled terms: Difficulties - Increase productions - Integrated tools - Shale gas reservoirs - Technical countermeasures - Technical difficulties - Wellbore - Wellbore plugging

Classification code: 443.3 Precipitation - 483.1 Soils and Soil Mechanics - 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512.1.1 Oil Fields - 512.2.1 Natural Gas Fields - 522 Gas Fuels - 604.2 Machining Operations - 802.3 Chemical Operations

DOI: 10.3787/j.issn.1000-0976.2019.08.010

Database: Compendex

201.

Accession number: 20193207284528

Title: **A practical engineering model for quick calculation of solution gas oil ratios**

Authors: Wei, Na ; Xi, Yongzhao ; Liu, Anqi ; Zhao, Jinzhou ; Zhang, Liehui ; Lü, Xin ; Li, Shutao ; Zhao, Xiangyang

Author affiliation: State Key Laboratory of Oil & Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

Institute of Geological Exploration and Development, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610501, China

CNOOC Research Institute, Beijing; 100027, China

Sinopec Research Institute of Petroleum Engineering, Beijing; 100101, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 4

Issue date: April 25, 2019

Publication year: 2019

Pages: 90-95

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The solubility of natural gas in crude oil is one of the important parameters of oil and gas solubility. In engineering, it can be obtained only from the chart, but the results are not accurate enough and this method is not convenient to use and not applicable for quick field application. In order to accurately and quickly calculate the solubility in the actual engineering, it is necessary to take points from the chart of API relative density and dead oil molar mass in the Lasater model and fit them into a functional relationship. Then, based on the original Lasater relation, a new model was derived from the mathematical model. So long as 4 known parameters (i.e., absolute pressure, temperature, relative density of dead oil to water and relative density of natural gas to air) are introduced into this new model, the solution gas oil ratio (GOR) can be calculated quickly by a computer. And the following research results were obtained. First, compared with Lasater relation, this new model simplifies the tedious iteration, and it can not only calculate the solution GOR in one step, but also reflect the effects of each parameter on the solution GOR in its formula. Second, the GOR increases with the increase of absolute pressure, decreases with the increase of temperature and relative density of natural gas to air, and increases firstly and then decreases with the increase of relative density of dead oil to water. In conclusion, this new model can accurately and quickly calculate the solution GOR and its calculation result is highly consistent with that of the Lasater model. In addition, this new method improves the calculation efficiency and accuracy of solution GORs in engineering, thus it is worth popularizing.

Number of references: 15

Main heading: Density of gases

Controlled terms: Gases - Iterative methods - Mathematical models - Molar ratio - Natural gas - Professional aspects - Solubility

Uncontrolled terms: Calculation efficiency - Calculation results - Dead-oil - Functional relationship - Practical engineering - Relative density - Solution gas - Solution gas oil ratios (GOR)

Classification code: 522 Gas Fuels - 801.4 Physical Chemistry - 901.1 Engineering Professional Aspects - 921.6 Numerical Methods - 931.2 Physical Properties of Gases, Liquids and Solids

DOI: 10.3787/j.issn.1000-0976.2019.04.012

Database: Compendex

202.

Accession number: 20194207561325

Title: **Low-amplitude abnormality eliminating techniques in S-wave seismic exploration in the Sanhu Depression, Qaidam Basin**

Title of translation: **柴达木盆地三湖坳陷横波勘探中的低幅异常消除技术**

Authors: Wang, Haili ; Deng, Zhiwen ; Huang, Hanqing ; Yu, Baohua ; Yin, Wuhai ; Ma, Lixin ; Li, Meihua

Author affiliation: Qinghai Geophysical Prospecting Department of BGP INC., CNPC, Jiuquan; Gansu; 736200, China

CNPC BGP INC., Zhuozhou; Hebei; 072750, China

Research Institute of BGP INC., CNPC, Zhuozhou; Hebei; 072750, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Publication year: 2019

Pages: 33-40

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In recent years, S-wave seismic exploration has been performed in the Sanhu Depression of the Qaidam Basin, but low-relief

structures are developed in this area, which are mixed with the "low-amplitude" abnormality caused by S-wave static correction and can be hardly distinguished. In this area, S-wave surface survey can hardly control the variation of the surface S-wave velocity model, the near-offset first arrival of S-wave is seriously contaminated, and the high-velocity interface cannot be determined easily due to the development of S-wave refracting layers. In view of these difficulties, the first arrival of S-wave in the contaminated area was firstly predicted using the curve fitting technique to ensure the integrity of the first arrival. Then, S-wave surface velocity was inverted under the joint constraint of the surface wave model and the multilayer refraction stratification. Finally, the low-amplitude abnormality eliminating techniques used for S-wave velocity interface were determined using the horizon matching modeling technique based on velocity spectrum analysis. What's more, these techniques were applied on site and their application effect was evaluated. And the following research results were obtained. First, the curve fitting technique can compensate the blank first arrival of S-wave in the contaminated area near the trace, so as to ensure the integrity of the tomographic inversion model. Second, the inversion modeling based on the dispersion characteristics of Rayleigh wave can provide the reliable data of the shallow S-wave velocity in this area so as to improve the accuracy of the shallow model. Third, the inversion under the joint constraint of the surface wave model and the multilayer refraction stratification can invert the surface S-wave velocity field in this area more accurately, so the S-wave velocity model can be better established and the "low-amplitude" abnormality in the S-wave section can be eliminated. In conclusion, the proposed techniques for eliminating the low-amplitude abnormality in S-wave seismic exploration can eliminate the "low-amplitude" abnormality caused by S-wave static correction, so as to improve the imaging quality of S-wave seismic data.

Number of references: 23

Main heading: Shear waves

Controlled terms: Acoustic wave velocity - Curve fitting - Multilayers - Refraction - Seismic prospecting - Seismology - Spectrum analysis - Surface waves - Tomography - Wave propagation

Uncontrolled terms: Low-amplitude - Qaidam basin - S-wave velocity - S-waves - Sanhu Depression - Surface wave inversion

Classification code: 484.1 Earthquake Measurements and Analysis - 746 Imaging Techniques - 751.1 Acoustic Waves - 921.6 Numerical Methods - 931.1 Mechanics

DOI: 10.3787/j.issn.1000-0976.2019.08.004

Database: Compendex

203.

Accession number: 20193607404651

Title: **Assignment mechanism of mineral rights among giant state-owned oil and gas enterprises: Review and proposals**

Authors: Tang, Guoqiang ; Xu, Dong ; Zhang, Baosheng

Author affiliation: China University of Petroleum, Beijing, Beijing; 102249, China

PetroChina Planning and Engineering Institute, Beijing; 100083, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 6

Issue date: June 25, 2019

Publication year: 2019

Pages: 147-155

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: China issued in 2017 Some Opinions on Deepening Reform of Petroleum and Natural Gas System. Subsequently, relevant ministries successively issued a series of new policies on oil and gas related reform, one of which is that the marketization process of oil and gas exploration and development is encouraged to be accelerated. Under the background of oil and gas system reform, it is of great practical significance to study the assignment mechanism among those state-owned giant oil and gas enterprises. Therefore, combined with the main practices of mineral rights management in other countries and the assignment of mineral rights of international oil companies, based on China's oil and gas mineral rights assignment policy, competitive assignment and assignment practices, the basic ideas and mechanisms for the assignment of mineral rights of giant state-owned oil and gas enterprises were proposed as follows. (1) Follow the guiding ideology of hierarchical classification and phasing, and generally adhere to the principles of marketization and of "four categories, three methods & two stages" in the design of the framework of mineral right

assignment. (2) Set up a mineral rights management leading group as well as specialized risk exploration companies, improve the decision-making mechanism for the assignment of mineral rights, and complete the management of the assignment of mineral rights. (3) Continue to strengthen the protection and internal assignment of mineral rights in Classes I and II blocks. In the short term, it is necessary to strengthen special investment in key guarantee blocks, continue to promote internal assignment, and innovate exploration and unused reserves project management system and mechanism, innovate the cooperation mechanism of Party A and Party B. In the long term, it is necessary to explore effective mineral rights management system, establish a linkage mechanism for mineral rights protection and assignment, and foster a competitive and competitive internal mineral rights market. (4) Appropriately increase the proportion of cooperative exploration and development of mineral rights joint venture and cooperation of Class III blocks, and focus on offshore and deep-water cooperative exploration and development projects. (5) Gradually explore the external competitive assignment of Class IV blocks, expand the scope of assignment in light of the progress of national qualification approval in the short run, and realize market-oriented competitive assignment in the long run.

Number of references: 22

Main heading: Offshore petroleum prospecting

Controlled terms: Classification (of information) - Commerce - Decision making - Gases - Investments - Mineral exploration - Minerals - Natural gasoline plants - Offshore gas fields - Offshore oil well production - Offshore oil wells - Project management

Uncontrolled terms: Decision mechanism - Decision-making mechanisms - Hierarchical classification - International oil companies - Oil and gas - Oil and gas exploration - Project management system - Rights management

Classification code: 482.2 Minerals - 501.1 Exploration and Prospecting Methods - 511.1 Oil Field Production Operations - 512 Petroleum and Related Deposits - 513.2 Petroleum Refineries - 716.1 Information Theory and Signal Processing - 912.2 Management

DOI: 10.3787/j.issn.1000-0976.2019.06.017

Database: Compendex

204.

Accession number: 20193207285075

Title: **Prevention and control technologies for the resonance**

induced potential troubles of a CNG bus's high-pressure gas supply pipeline

Authors: Wang, Yidong ; He, Taibi ; Zhang, Xinyan ; Wang, Yan

Author affiliation: School of Automobile & Transportation, Xihua University, Chengdu; Sichuan; 610039, China

Geely Group Powertrain Research Institute, Ningbo; Zhejiang; 315000, China

Chengdu Technician College, Chengdu; Sichuan; 611730, China

Corresponding author: He, Taibi (41253198@qq.com)

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Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Publication year: 2019

Pages: 123-128

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 16

Main heading: Pipelines

Controlled terms: Analytic hierarchy process - Automobile engines - Buses - Degrees of freedom (mechanics) - Finite element method - Gas supply - Modal analysis - Natural frequencies - Optimization - Resonance

Uncontrolled terms: Constraint position - Dynamic characteristics - Excitation frequency - Guiding significances - High pressure gas - Prevention and controls - Vibration characteristics - Vibration properties

Classification code: 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 661.1 Automotive Engines - 663.1 Heavy Duty Motor Vehicles - 921 Mathematics - 931.1 Mechanics - 961 Systems Science

DOI: 10.3787/j.issn.1000-0976.2019.05.015

Database: Compendex

205.

Accession number: 20193207285175

Title: **Analysis and prediction on the disaster effect of leakage accidents at large LNG receiving stations**

Authors: Wang, Zhihuan ; Li, Chengbing ; Zhou, Ning

Author affiliation: School of Mechanical Engineering, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

School of Petroleum Engineering, Changzhou University, Changzhou; Jiangsu; 213164, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 5

Issue date: May 25, 2019

Publication year: 2019

Pages: 145-153

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 23

Main heading: Liquefied natural gas

Controlled terms: 3D modeling - Accidents - Cofferdams - Diffusion - Disaster prevention - Disasters - Explosions - Forecasting - Leakage (fluid) - Site selection - Wind

Uncontrolled terms: Flacs - Flammable gas cloud - Liquefied Natural Gas (LNG) - Prediction model - Receiving stations

Classification code: 443.1 Atmospheric Properties - 523 Liquid Fuels - 914.1 Accidents and Accident Prevention

Numerical data indexing: Size 1.70e+02m, Size 2.14e+02m, Size 2.62e+02m, Size 3.70e+02m, Time 3.00e+02s

DOI: 10.3787/j.issn.1000-0976.2019.05.018

Database: Compendex

206.

Accession number: 20193607404742

Title: **New technologies for site selection and evaluation of salt-cavern underground gas storages**

Authors: Zheng, Yali ; Wanyan, Qiqi ; Qiu, Xiaosong ; Kou, Yanxia ; Ran, Lina ; Lai, Xin ; Wu, Shuang

Author affiliation: PetroChina Research Institute of Petroleum Exploration & Development, Langfang; Hebei; 065007, China

CNPC Key Laboratory of Underground Oil/Gas Storage, Langfang; Hebei; 065007, China

Production Operations Department, Chuan-Yu Shale Gas Front-line Command Post, PetroChina, Chengdu; Sichuan; 610051, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

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Issue date: June 25, 2019

Publication year: 2019

Pages: 123-130

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 21

Main heading: Underground gas storage

Controlled terms: Caves - Commerce - Digital storage - Gas industry - Natural gas - Petroleum industry - Salt deposits - Salt mines - Site selection

Uncontrolled terms: Appraisal system - Case analysis - Huai'an Salt Mine (Jiangsu) - Salt caverns - Strata feature

Classification code: 481.1 Geology - 505.1 Nonmetallic Mines - 522 Gas Fuels - 722.1 Data Storage, Equipment and Techniques

DOI: 10.3787/j.issn.1000-0976.2019.06.014

Database: Compendex

207.

Accession number: 20200408064931

Title: **The analysis of condction mechanism of China's LNG spot price**

Title of translation: **中国液化天然气现货价格的传导机制**

Authors: Xiao, Jianzhong ; Wang, Xuan

Author affiliation: School of Economics and Management, China University of Geosciences-Wuhan, Wuhan; Hubei; 430074, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: November 25, 2019

Publication year: 2019

Pages: 117-125

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 23

Main heading: Crude oil price

Controlled terms: Commerce - Costs - Gases - Impulse response - Liquefied natural gas

Uncontrolled terms: China - Natural gas price - Pricing mechanism - Spot LNG price - VAR models

Classification code: 523 Liquid Fuels - 911 Cost and Value Engineering; Industrial Economics

Numerical data indexing: Percentage 4.00e+01%

DOI: 10.3787/j.issn.1000-0976.2019.11.016

Database: Compendex

208.

Accession number: 20194207561312

Title: **Effect of salt contents on the gas hydrate anti-agglomerant performance**

Title of translation: **盐含量对天然气水合物防聚剂性能的影响**

Authors: Jiang, Shanliang ; Chen, Chao ; Li, Guanbao ; Li, Honggang ; Wang, Xiaohui ; Qin, Huibo

Author affiliation: Guangzhou Special Pressure Equipment Inspection and Research Institute, Guangzhou; Guangdong; 510663, China

Key Laboratory of Gas Hydrate, Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences, Guangzhou; Guangdong; 510640, China

State Key Laboratory of Heavy Oil Processing, China University of Petroleum, Beijing; 102249, China

Guangdong University of Petrochemical Technology, Maoming; Guangdong; 525000, China

Corresponding author: Qin, Huibo (hbqin1230@sina.com)

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Publication year: 2019

Pages: 120-125

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Number of references: 21

Main heading: Gas hydrates

Controlled terms: Agglomeration - Drops - Emulsification - Gases - Hydration - Light transmission - Morphology - Natural gas - Particle size - Particle size analysis - Sapphire - Size distribution - Sodium chloride - Surface tension

Uncontrolled terms: Agglomeration effects - Hydrate particles - Hydrate slurry - Mechanical stirring - Performance evaluation - Salt content - Salt-containing - Transparent sapphires

Classification 482.2.1 Gems - 522 Gas Fuels - 741.1 Light/Optics - 802.3

code: Chemical Operations - 922.2 Mathematical Statistics - 931.2 Physical Properties of Gases, Liquids and Solids - 951 Materials Science

Numerical data indexing: Percentage 3.00e+00%, Surface_Tension 4.45e-03N*m

DOI: 10.3787/j.issn.1000-0976.2019.08.015

Database: Compendex

209.

Accession number: 20192206992453

Title: **Strategic role of the synthetic hydrogen production and industry in Energy Independence of China**

Title of translation: **人工制氢及氢工业在我国"能源自主"中的战略地位**

Authors: Zou, Caineng ; Zhang, Fudong ; Zheng, Dewen ; Sun, Fenjin ; Zhang, Jinhua ; Xue, Huaqing ; Pan, Songqi ; Zhao, Qun ; Zhao, Yongming ; Yang, Zhi

Author affiliation: PetroChina Research Institute of Petroleum Exploration and Development, Beijing; 100083, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 1

Issue date: January 25, 2019

Publication year: 2019

Pages: 1-10

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: We are now experiencing the global third energy transition from fossil to non-fossil fuels such as hydrogen energy. In order to provide some reference for decision makers to strive for energy transformation and energy independence in China, we first overviewed the status and developing trend of hydrogen industry at home and abroad, then discussed the development ways of synthetic hydrogen production and storage technologies, and finally emphasized the strategic position of

hydrogen industry. The following findings were achieved. (1) To develop the hydrogen industry is a strategic choice to optimize the energy structure and guarantee the national energy security, and will play an important role in achieving the goal of energy independence in China. (2) The global hydrogen industry has reached a certain scale, and fossil energy resources are still the main raw materials for hydrogen production; hydrogen made from in-situ coal gasification accords with the national condition of China, showing a great potential. (3) New energy sources integrated with hydrogen energy will be the main trend of future energy consumption. (4) Hydrogen production from electrolytic water will go through the whole process of hydrogen industry. (5) Safe and high-efficiency hydrogen storage is the key to the practical application of hydrogen energy and liquid hydrogen storage will be the dominated way in the future. On this basis, the following conclusions and proposals were put forward. (1) Although the infrastructure is still at the initial stage, the hydrogen industry is developing fast. (2) In the short run, breakthrough will be made in hydrogen production from the in-situ coal gasification and such hydrogen industry chain will be preliminarily formed. (3) In the middle run, hydrogen industry will be driven to be a new economic growth point and play an important role in new energy strategies. (4) In the long run, hydrogen energy will be such an important part in the energy mix that not only "Hydrogen China" but "Energy Independence of China" will be both achieved with the assistance of new energy sources.

Number of references: 14

Main heading: Coal industry

Controlled terms: Chemical industry - Coal deposits - Coal gasification - Decision making - Economics - Energy security - Energy utilization - Fossil fuels - Hydrogen fuels - Hydrogen production - Hydrogen storage - Liquefied gases

Uncontrolled terms: China - Energy independence - Energy transformation - High-efficiency - Hydrogen Energy - Industry chain - New energies

Classification code: 503 Mines and Mining, Coal - 522 Gas Fuels - 525.3 Energy Utilization - 525.6 Energy Policy - 805 Chemical Engineering, General - 912.2 Management - 971 Social Sciences

DOI: 10.3787/j.issn.1000-0976.2019.01.001

Database: Compendex

210.

Accession 20192607089035

number:

Title: **Reserve evaluation of high pressure and ultra high pressure reservoirs with power function material balance method**

Title of translation: **基于幂函数形式物质平衡方法的高压, 超高压气藏储量评价**

Authors: Sun, Hedong ; Wang, Hongyu ; Zhu, Songbai ; Nie, Haifeng ; Liu, Yang ; Li, Yuanjie ; Li, Songlin ; Cao, Wen ; Chang, Baohua

Author affiliation: PetroChina Research Institute of Petroleum Exploration & Development, Langfang; Hebei; 065007, China

PetroChina Tarim Oilfield Company, Korla; Xinjiang; 841000, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

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Issue date: March 25, 2019

Publication year: 2019

Pages: 56-64

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: It is difficult to determine the effective reservoir rock compressibility, aquifer volume and water influx of high pressure and ultra high pressure gas reservoirs, so when the traditional apparent reservoir pressure and cumulative gas production curve extrapolation method and its modified version are used to calculate the initial gas in-place of such gas reservoirs, the calculation accuracy is lower. The material balance equation in the form of power function for such gas reservoirs was established based on Gonzalez method in order to improve the accuracy and reliability of reserve evaluation. Then, based on 20 high pressure and ultra high pressure reservoirs that had been developed abroad, the empirical value of the power exponent was defined, and the influences of the depletion degree of apparent reservoir pressure and the degree of reserve recovery on the reliability of reserve calculation were analyzed. Besides, the critical value of the key parameter affecting the reliability of reserve evaluation (depletion degree of apparent reservoir pressure) was determined and compared with the critical value of the two-linear trends. Finally, an example calculation was carried out. And the following research results were obtained.

First, the empirical value of the power exponent calculated using the material balance method in the form of power function is 1.028 47, with an upper limit of 1.115 67. Second, the depletion degree of apparent reservoir pressure corresponding to the inflection point of the classical two-linear trends ranges from 0.14 to 0.38 with an average of 0.23 while that corresponding to the extrapolation point of the second straight line is between 0.23 and 0.50 with an average of 0.33 and the corresponding degree of reserve recovery is in the range of 33%-65% with an average of 45%. Third, the reserves of such high pressure gas reservoirs calculated with this new method has an error rate less than 10% if the depletion degree of apparent reservoir pressure is greater than 0.33. In conclusion, for such high pressure gas reservoirs and the stress-sensitive fractured gas reservoirs, the material balance method in the form of power function proposed in this paper can avoid the uncertainty parameters (e.g. effective reservoir rock compressibility, aquifer volume and water influx) and it is advantageous with simple calculation process, better practicability and small error.

Number of references: 34

Main heading: Petroleum reservoir evaluation

Controlled terms: Aquifers - Compressibility - Extrapolation - Function evaluation - Gas industry - Gases - High pressure engineering - High pressure pipelines - Petroleum reservoirs - Proven reserves - Reliability - Reservoirs (water) - Rocks

Uncontrolled terms: Cumulative gas productions - Initial gas in-place - Power functions - Reservoir pressures - Rock compressibility - Ultra-high pressure gas reservoir

Classification code: 441.2 Reservoirs - 444.2 Groundwater - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 921.6 Numerical Methods - 951 Materials Science

Numerical data indexing: Percentage 1.00e+01%, Percentage 3.30e+01% to 6.50e+01%, Percentage 4.50e+01%

DOI: 10.3787/j.issn.1000-0976.2019.03.007

Database: Compendex

211.

Accession number: 20192206992462

Title: **A calculation method for the allowable fracturing injection pressure of preventing casing deformation**

Title of **预防套管变形的许用压裂注入压力计算方法**

translation:

Authors: Shen, Xinpu ; Zhang, Ping

Author affiliation: China University of Petroleum <East China >, Qingdao; Shandong; 266580, China

Tianjin Chenxing Engineering and Technology LLC, Tianjin; 301500, China

Engineering Technology Department, CNPC Chuanqing Drilling Engineering Co., Ltd., Chengdu; Sichuan; 610051, China

Source title: Natural Gas Industry

Abbreviated source title: Natur. Gas Ind.

Volume: 39

Issue: 1

Issue date: January 25, 2019

Publication year: 2019

Pages: 87-96

Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Injection pressure is one of the key parameters used in the design of shale gas reservoir stimulation. Higher injection pressure helps to initiate fractures, inject fracturing fluid and proppant smoothly and maximize the stimulated reservoir volume as soon as possible. If the injection pressure is too high, however, the risk of casing deformation is increased significantly. In this paper, the numerical calculation format of the injection pressure safety window while ensuring casing integrity (i.e., maximum safety injection pressure) was proposed based on an example of an actual engineering project. Then, it was verified based on the actual situation of one shale gas well in Weiyuan. The numerical calculation format is as follows. First, a 3D finite element model of initial fine geostress field is established in the scale of block. Second, a primary submodel for introducing the asymmetric characteristics of reservoir stiffness to simulate the asymmetry of fracture distribution. Third, a secondary submodel containing the attributes of casing, cement sheath and reservoir material properties. Fourth, submodels are used to calculate the casing deformation generated by different injection loads and estimate the maximum allowable fracturing injection pressure (pj) while the safety requirement of casing deformation is satisfied. The calculation result of the case well shows that when the cementing quality is poor and fractures are distributed

asymmetrically, the lateral and vertical displacements at the maximum displacement point of the casing under the injection pressure of 80 MPa are obviously lower than those under 90 MPa. According to the yield limit criterion of P-110 casing steel, the casing deformation in this case is elastic strain, so the injection pressure of 80 MPa is safe. In conclusion, this method has rational precision and accuracy, for its numerical result is consistent with the actual engineering phenomenon.

Number of references: 23

Main heading: Numerical methods

Controlled terms: Cements - Deformation - Fracturing fluids - Hydraulic fracturing - Oil well cementing - Petroleum reservoirs - Precision engineering - Safety engineering - Shale gas

Uncontrolled terms: Casing integrity - Cement sheath - Geo-stress - Injection pressures - Shale gas reservoirs - Submodels - Weiyuan Block

Classification code: 412.1 Cement - 512.1.1 Oil Fields - 512.1.2 Petroleum Deposits : Development Operations - 522 Gas Fuels - 914 Safety Engineering - 921.6 Numerical Methods

Numerical data indexing: Pressure 8.00e+07Pa, Pressure 9.00e+07Pa

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Database: Compendex

212.

Accession number: 20192206992467

Title: **Impact of rockfalls on the Lancangjiang River suspending pipeline and control measures**

Title of translation: **澜沧江跨越管道的落石冲击影响与防护**

Authors: Chen, Liqiong ; Liu, Yang ; Wu, Shijuan ; Lai, Jinhe ; Zhang, Xinglong

Author affiliation: Petroleum Engineering School, Southwest Petroleum University, Chengdu; Sichuan; 610500, China

The No.3 Gas Production Plant, Sinopec Southwest Oil & Gas Company, Deyang; Sichuan; 618100, China

PetroChina Yumen Oilfield Company, Jiuquan; Gansu; 735200, China

PetroChina Southwest Pipeline Company, Chongqing; 404100, China

Corresponding author: Liu, Yang (2721095205@qq.com)

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: In order to ensure the safe operation of the suspending pipeline crossing the Lancangjiang River, it is necessary to explore a scheme on its rockfall control. In this paper, the rockfalls on the left bank of the Lancangjiang River suspending pipeline were taken as the study object. Their movement was simulated by using the Rocfall software, and the influences of weight and dropping height of rockfall on its striking position in the pipeline and its maximum kinetic energy while striking the pipeline were analyzed. Then the rockfall weight inducing the pipeline failure was calculated by loading on the pipeline model in the CAESARII software. Finally, the rockfall control measure was proposed based on the topography at the left bank, combined with the distribution situations of rockfalls. And the following research results were obtained. First, the weight and dropping height of rockfall have little effect on its striking position in the pipeline. The striking points are distributed in a range of 13 m from the beginning of the suspending pipeline. Second, the kinetic energy of falling rock hitting the pipeline is less affected by the dropping height, but it is almost linearly related to the weight. Third, the rockfalls exceeding 1 000 kg may lead to pipeline failures. Fourth, by setting SNS flexible protection mesh with the height of 2 m and 4 m at the coordinates (208 m, 1 274 m) and (250 m, 1 225 m) respectively, the rockfalls can be effectively intercepted so as to ensure the safety of the Lantsangjiang River suspending pipeline. In conclusion, the striking possibility of rockfalls on the Lancangjiang River suspending pipeline can be reduced effectively and its safety can be ensured by studying the rockfall movement and taking active protection measures.

Number of 19

references:

Main heading: Pipelines

Controlled terms: Accident prevention - Computer system recovery - Kinetic energy - Kinetics - Mesh generation - Rivers - Rock bursts - Topography

Uncontrolled terms: Active protection - Influence - Pipeline crossing - Pipeline failures - Pipeline modeling - Protecting mesh - Rocfall CAESARII - Rockfalls

Classification code: 619.1 Pipe, Piping and Pipelines - 723.5 Computer Applications - 914.1 Accidents and Accident Prevention - 931 Classical Physics; Quantum Theory; Relativity - 951 Materials Science

Numerical data indexing: Mass 1.00e+03kg, Size 1.22e+03m, Size 1.27e+03m, Size 1.30e+01m, Size 2.00e+00m, Size 2.08e+02m, Size 2.50e+02m, Size 4.00e+00m

DOI: 10.3787/j.issn.1000-0976.2019.01.015

Database: Compendex

213.

Accession number: 20192607089037

Title: **Working mechanism of nano-SiO2 sol to alleviate the strength decline of oil well cement under high temperature**

Title of translation: **纳米SiO2溶胶缓解油井水泥高温强度衰退的作用机理**

Authors: Wang, Chengwen ; Chen, Xin ; Zhou, Wei ; Wang, Yonghong ; Xue, Yucheng ; Luo, Faqiang

Author affiliation: Key Laboratory of Unconventional Oil & Gas Development//China University of Petroleum <East China>, Qingdao; Shandong; 266580, China

School of Petroleum Engineering, China University of Petroleum <East China>, Qingdao; Shandong; 266580, China

Department of Civil and Environmental Engineering, University of Alberta, Edmonton; AB; T6G 2W2, Canada

Research Institute of Petroleum Engineering, Sinopec Northwest, Urumqi; Xinjiang; 830011, China

Corresponding author: Chen, Xin (xc11@ualberta.ca)

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Language: Chinese

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CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: Strength decline of oil well set cement is one of the major challenges during well cementing under high temperature. Therefore, it is necessary to verify and confirm whether nano-SiO2 can mitigate this problem and its working mechanism. In this paper, the mineral composition and microstructure of set cement and the elements of its hydration product were experimentally analyzed by using a X-ray diffractometer, a scanning electron microscope and an energy spectrometer. Then, the effect of nano-SiO2 sol on the compressive strength of Class G oil well set cement and its change laws under high temperature (150℃/35 MPa) were investigated. Based on this, the working mechanism of nano-SiO2 sol on the hydration product of cement under high temperature was studied. And the following research results were obtained. First, nano-SiO2 sol can increase the consistency coefficient of Grade G oil well slurry and has an adverse impact on the rheological property of slurry. Second, nano-SiO2 sol can decrease the compressive strength of set cement in the early stage of high temperature curing, but the compressive strength of the set cement with nano-SiO2 sol will not change obviously as the curing goes. Third, if a small amount of nano-SiO2 sol is added into Grade G oil well cement, nano-SiO2 particles are adsorbed to the surface of cement minerals to hinder the hydration reaction, so it can mitigate the evaporation metamorphism of the hydration product of cement under high temperature. Besides, nano-SiO2 particles can improve the micro-structural compactness of the cement. Fourth, if a large amount of nano-SiO2 sol is added into Grade G oil well cement, pozzolanic reaction happens between nano-SiO2 and calcium hydroxide, generating a new type of structurally loose honeycomb calcium silicate hydrate (CSH) product, which cannot provide higher compressive strength. In conclusion, nano-SiO2, as cement additive, can mitigate the strength retrogression of oil well cement under high temperature. These research results provide a new idea for the design of a high-temperature cement slurry system.

Number of references: 27

Main heading: Oil well cementing

Controlled terms: Calcium silicate - Cements - Compressive strength - Curing - Hydrated lime - Hydration - Lime - Microstructure - Petroleum additives - Petroleum industry - Scanning electron microscopy - Silica - Silicate minerals - Silicon - Sols

Uncontrolled terms: Class G - High temperature - Hydration products - Mitigation of strength retrogression - Nano-SiO2

Classification code: 412.1 Cement - 482.2 Minerals - 512.1.2 Petroleum Deposits : Development Operations - 549.3 Nonferrous Metals and Alloys excluding Alkali and Alkaline Earth Metals - 802.2 Chemical Reactions - 804 Chemical Products Generally - 804.2 Inorganic Compounds - 951 Materials Science

DOI: 10.3787/j.issn.1000-0976.2019.03.009

Database: Compendex

214.

Accession number: 20192607089041

Title: **Optimized control of line pack of gas pipeline**

Title of translation: **输气管道的管存量优化控制**

Authors: Chang, Haijun ; Dai, Zhengyu ; Ding, Yuan

Author affiliation: PetroChina Pipeline Company, Beijing; 100029, China

CNPC Procurement & Equipment Management Department, Beijing; 100007, China

PetroChina Beijing Gas Pipeline Co., Ltd., Beijing; 100101, China

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Pages: 102-108

Language: Chinese

ISSN: 10000976

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: So far, there has been no unified criterion on the line pack

control at home and abroad, and the line pack control principle is commonly formulated based on operation experience, combined with pipeline simulation. In addition, there is no theoretical calculation basis for maximum, minimum and optimum line packs. In this paper, the Trans-Asia Gas Pipeline AB was taken as the research object. Its maximum, minimum and optimum line packs were calculated by means of the dynamic programming algorithm. Then, a set of three-level line pack control principles and methods for gas pipelines were developed based on operation experience and pipeline simulation results. And the following research results were obtained. First, for a given pipeline throughput, the maximum and minimum safe line packs are determined using the dynamic programming method while the feasible operation ranges of gas turbine driven units in compressor stations and the limit values of pipeline operation are satisfied. Second, based on the operation dispatching experience, a reasonable interval of line pack for normal operation of a gas pipeline is determined by conducting simulation. Third, the operation scheme with the minimum self-consuming gas (or energy consumption) and its corresponding line pack are determined by using the dynamic programming method, and it is taken as the objective of line pack control during daily pipeline operation. Fourth, when this line pack optimization method is applied in the Trans-Asia Gas Pipeline AB, at the same pipeline throughput, the self-consuming gas is 383.8 thousand m more, the average efficiency of centrifugal compressors is 0.21% higher, and percentage of outlet pressure of 9.50-9.65 MPa of compressor stations is 6.6% higher in 2014 than in 2013. It is concluded that by virtue of this method, the line pack can be controlled below the maximum safe line pack and above the minimum safe line pack, and it can be kept according to the minimum self-consuming gas as much as possible.

Number of references: 14

Main heading: Pipelines

Controlled terms: Centrifugal compressors - Dynamic programming - Energy utilization - Gas pipelines - Gases - Piping systems

Uncontrolled terms: Average efficiencies - Compressor stations - Dynamic programming algorithm - Dynamic programming methods - Operation experiences - Simulation - Theoretical calculations - Trans-Asia Gas Pipeline AB

Classification code: 525.3 Energy Utilization - 618.1 Compressors - 619.1 Pipe, Piping and Pipelines - 921.5 Optimization Techniques

Numerical data indexing: Percentage 2.10e-01%, Percentage 6.60e+00%, Pressure 9.50e+06Pa to 9.65e+06Pa

DOI: 10.3787/j.issn.1000-0976.2019.03.013

Database: Compendex

215.

Accession number: 20192607106207

Title: **Coiled tubing testing technology for testing the injection-production capacity of horizontal wells with high gas injection-production rates: A case study of the Xiangguosi Underground Gas Storage in Chongqing**

Title of translation: **适用于大注采气量水平井注采能力测试的连续油管测试技术-以重庆相国寺地下储气库为例**

Authors: Xie, Nanxing ; Sun, Fengjing ; Wang, Weilin ; Tan, Hao ; Ren, Ke ; Li, Limin ; Wang, Yan

Author affiliation: Engineering Technology Research Institute, PetroChina Southwest Oil & Gasfield Company, Chengdu; Sichuan; 610017, China

Gas Storage Administrative Division, PetroChina Southwest Oil & Gasfield Company, Chongqing; 400700, China

Corresponding author: Sun, Fengjing (sun_fj@petrochina.com.cn)

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Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: The injection-production wells of the Xiangguosi Underground Gas Storage (UGS) in Chongqing are mostly highly-deviated wells and horizontal wells. The completion strings are complex and the gas injection-production rate of single well is high, so it is difficult to test the injection-production capacity of gas wells by using conventional testing tools, instruments and processes. For this reason, it is in urgent need to develop a suitable testing technology. In this paper, a coiled tubing testing technology

suitable for the injection-production capacity testing of horizontal wells with high gas injection-production rate in the Xiangguosi UGS was developed through tool matching, instrument improvement and process optimization. And this technology has been successfully applied to the injection-production capacity testing of 10 wells by 12 times. Finally, the testing results were comparatively analyzed. And the following research results were obtained. First, this coiled tubing testing technology can satisfy the requirements of injection-production capacity testing of horizontal wells with high gas injection-production rates. And the tested maximum gas injection and production rates are 260×10 m/d and 225×10 m/d, respectively. Second, even in the same well, the injection-production capacity is different, so it is necessary to test and evaluate the injection-production capacity of each well in different injection and production cycles. Third, at high gas injection rate, high-speed non-Darcy percolation occurs near the wellbore and it may threaten the injection-production safety. And after periodic gas injection, the decline of reservoir temperature near the wellbore will influence the storage capacity. In conclusion, this coiled tubing testing technology presents real and reliable data, and it provides a technical support for the injection-production capacity evaluation of injection-production wells of underground gas storages, the arrangement of single-well injection-p roduction plan and the check of storage capacity.

Number of references: 9

Main heading: Injection (oil wells)

Controlled terms: Boreholes - Coiled tubing - Digital storage - Gas industry - Horizontal wells - Instrument testing - Natural gas well completion - Natural gas well production - Oil field equipment - Optimization - Petroleum reservoir evaluation - Solvents - Underground gas storage - Well testing

Uncontrolled terms: Chongqing - Dynamic monitoring - Production capacity - Production rates - Production wells - Storage capacity - Testing technology

Classification code: 511.1 Oil Field Production Operations - 511.2 Oil Field Equipment - 512 Petroleum and Related Deposits - 522 Gas Fuels - 619.1 Pipe, Piping and Pipelines - 722.1 Data Storage, Equipment and Techniques - 803 Chemical Agents and Basic Industrial Chemicals - 921.5 Optimization Techniques

DOI: 10.3787/j.issn.1000-0976.2019.02.008

Database: Compendex

216.

Accession number: 20194207561173

Title: **Impact of cement slurry invasion on the propagation of hydraulic fractures in coal reservoirs**

Title of translation: **固井水泥浆侵入对煤储层压裂裂缝延展的影响**

Authors: Chen, Lichao ; Wang, Shengwei ; Zhang, Diankun ; Li, Rui ; Lü, Shuaifeng

Author affiliation: School of Mining and Technology, Inner Mongolia University of Technology, Hohhot; Inner Mongolia; 010051, China

State Key Laboratory of Coal and CBM Co-mining, Jincheng Anthracite Mining Group, Jincheng; Shanxi; 048204, China

Faculty of Earth Resources, China University of Geosciences, Wuhan; Hubei; 430074, China

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Abbreviated source title: Natur. Gas Ind.

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Language: Chinese

ISSN: 10000976

CODEN: TIGOE3

Document type: Journal article (JA)

Publisher: Natural Gas Industry Journal Agency

Abstract: At present, invasion mode, morphology and scale of cement slurry in the immediate vicinity of a coalbed methane (CBM) well and their impacts on the propagation of hydraulic fractures in coal reservoirs and their intrinsic relationships with the production effects of the CBM well were less researched. In order to deepen the theories on the propagation of hydraulic fractures in coal reservoirs and provide support for the optimization of CBM well hydraulic fracturing scheme, this paper selected the blocks in the Qinshui Basin whose matrix-fracture development combinations in coal reservoirs are totally different as the research objects. The invasion modes of cement slurry and the morphologies and scales of cement sheath in the wells deployed at different locations were characterized systematically, and the fracturing mechanics criteria in different invasion modes of cement slurry were analyzed. Then, in view of the drilling difficulties of deep gas wells, the actual problems related to the invasion characteristics of cement slurry were

dissected, and the definition of fracture pressure equivalent was proposed. Finally, the fracturing and production data of 39 CBM wells in the Zhengzhuang Block were analyzed, and the influences of different invasion modes of cement slurry on the fracturing and production of CBM wells were summarized. And the following research results were obtained. First, the invasion modes of cement slurry in CBM wells include three types, i.e., normal cementing type [primary structural coal matrix (PCM)], thickening type [tectonic coal (TC)] and coal-cement cementing interface type [primary structural coal fracture (PCF)]. Second, when the fracture pressure equivalent (pt) is less than 1.50 MPa, cement slurry is evenly filled in borehole-casing annulus of gas well, which indicates that the gas well is located at PCM; when pt is in the range of 1.50-9.00 MPa, cement slurry invades into the reservoir through the structural joint fissures to form cemented filter cakes, which indicates that the gas well is located at PCF; and when pt is greater than 9.00 MPa, cement slurry thickens to form spindles in the collapse space of hole annulus, which indicates that the gas well is located at TC. Third, the gas production rate of the CBM well deployed at PCM remains stable for a long time after increasing slowly to the peak, and then declines slowly. That of CBM well deployed at TC reaches its peak value rapidly at the initial stage of the production and then decreases quickly. It's the gas production rate of the CBM well deployed at PCF increases rapidly to the peak value at the initial stage of the production, but its stable production lasts short, and then it declines slowly.

Number of references: 20

Main heading: Natural gas wells

Controlled terms: Cements - Coal - Coal deposits - Fracture - Gases - Hydraulic fracturing - Methane - Oil well cementing

Uncontrolled terms: Cbm wells - Fracture pressures - Fracture propagation - Qinshui basin - Zhengzhuang Block

Classification code: 412.1 Cement - 503 Mines and Mining, Coal - 512.1.2 Petroleum Deposits : Development Operations - 512.2.1 Natural Gas Fields - 524 Solid Fuels - 804.1 Organic Compounds - 951 Materials Science

Numerical data indexing: Pressure 1.50e+06Pa, Pressure 1.50e+06Pa to 9.00e+06Pa, Pressure 9.00e+06Pa

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