

ABSTRACTS

Influence of borehole non-coupling coefficients on detonation effectiveness of seismic source in carbonate rock. Zhong Ming-shou¹, Long Yuan¹, Li Xing-hua¹, Chang Jian², and Zhang Yang-yi¹. *OGP*, 2011, 46 (2):165~169

In seismic exploration, usually explosive source energy is not strong enough and its frequency is high. This affects the quality of seismic data. We propose an improvement of non-coupling coefficient for seismic exploration in carbonate rocks. By building a model of detonation load, time functions of detonation load in carbonate media was calculated. The specialized experimental study shows: when the non-coupling coefficient is 1.5 in carbonate media, detonation load attenuation is slower, detonation load effect time is longer and coupling energy in rock is largest, which can generate a better seismic quality data. Theoretical calculations match very well with experimental results. This method can be used to get a non-coupling coefficient for better seismic source parameter selection in carbonate rocks.

Key words: source detonation, non-coupling coefficient, carbonate rocks, detonation load

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A method for source array design based on the phased-array theory. Xu Feng¹, Liu Fu-lie¹, and Li-ang Xiang-hao². *OGP*, 2011, 46 (2):170~175

For complex surface seismic exploration, source arrays are widely used to eliminate interference and improve shot record quality. The array length of 2D phased source or the array area of 3D phased source determines the beam width of directional seismic waves, namely the energy directional

focus state. Using the phased-array theory in military field, this work discusses a method for source array design by controlling the shooting time or the shooting depth to realize phase control. By designing an optimal source array, divergent spread seismic waves focus on a certain direction, namely synthesis directional beam. In this case, reflected energy level received by the acquisition system will be increased, and the signal-to-noise ratios of the data will also be enhanced.

Key words: phased-array theory, source array shooting, directional seismic wave, signal-to-noise ratio (SNR), explosion efficiency, seismic data acquisition

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Optimizing source parameters with correlation coefficient method. Jiang Fu-hao¹. *OGP*, 2011, 46 (2):176~181

During parameter tests for seismic data acquisition in the field, source parameters determination are made mainly through qualitative & quantitative analyses to frequency scan, energy, signal to noise ratio or frequency spectrum. Analysis results are often different because of different analyzers. The paper discusses parameter optimizing on the following assumptions: with repeated shootings at the same position, receiving with the same spread and same wavelet phase of different shots, and adopting correlation theory, correlations of seismic data with different source parameters are analyzed. Then the optimum source parameters are determined by comparing the correlation coefficients and stack correlation coefficients. Finally application examples are given.

Key words: correlation coefficient method, source factors, seismic data acquisition, repeated shootings at same position, same spread receiving, same

phase wavelet, stack correlation coefficient

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A high density 3D seismic acquisition case in Luojia area. Cai Xi-yuan¹, Han Wen-gong², Yu Jing², and Shi Lin-guang². *OGP*, 2011, 46(2):182~186

With the advance in both field equipment and seismic technology, significant progress of HD (high density) seismic acquisition has been made in recent years. In 2008, Shengli Oil Field of Sinopec has conducted a land HD seismic acquisition in Luojia area. This was the first HD acquisition with over 10,000 live channels of 3C digital sensors in China. We adopted single-receiving technique that means that a single 3C sensor was planted at each receiver point. Based on noise characteristics analysis in the working area, a centralized swath orthogonal symmetric geometry was used. This geometry improves continuity and uniformity of seismic events. Many methods were used to investigate near surface structures. Some minor near surface structure models were built. In field acquisition, receiver coupling was improved and data quality control was monitored by on-site processing. So high quality 3C data were acquired. At the same time, an efficient field operation procedure for large-live-channel-count survey was developed.

Key words: high density 3D seismic, seismic data acquisition, digital sensor, single-receiving, near surface investigation

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Numerical simulation of three-component elastic wavefield in 2D TTI media in the condition of the combined boundary. Du Qi-zhen¹, Sun Rui-yan¹, and Zhang Qiang². *OGP*, 2011, 46(2):187~195

In this work, based on the rotated staggered grid high-order finite-difference schemes of the first-order velocity-stress elastic wave equation, three-component elastic wavefield in the 2D TTI

(Tilted Transverse Isotropy) media is simulated after combining NPML (Non-splitting Perfect Match Layers) absorption condition and the free-surface boundary condition. The snapshot and synthetic records illustrate: 1. The NPML absorption condition can efficiently attenuate near-surface incidence waves and evanescent waves; 2. Comparison with the NPML absorption condition, the combined boundary conditions not only attenuate boundary reflections, but also accurately simulate free-surface situation and obtain full waves seismic data. Among these waves, PS converted wave as a special phenomenon provide useful information for the near surface structure investigation and multi-wave wavefield analysis; 3. Rayleigh surface wave and surface multiples generated in the free-surface boundary have an important influence on seismic imaging, thus the free surface condition should be taken account in seismic data processing. The simulation results indicate the numerical simulation of elastic wavefield in the 2D TTI media based on the combined boundary conditions is feasible and valid.

Key words: finite-difference scheme; rotated staggered grid; NPML (Non-splitting Perfect Match Layers) absorption condition; free-surface boundary condition; combined boundary conditions; TTI (Tilted Transverse Isotropy) media; first-order velocity-stress elastic wave equation; wavefield; numerical simulation

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Kinematic forward modeling based on block-model for crosswell seismic. Li Hui-feng¹, Wang Yan-jun¹ and Fan Ting-en². *OGP*, 2011, 46(2):196~201

In forward modeling methods of surface seismic, only upgoing reflection waves were considered, and the information such as transmission wave, interlayer direct wave and downgoing wave were not involved. Furthermore, these methods are only suitable for simple layered model while it can-

not be applied to crosswell seismic. In this paper, a kinematic forward modeling method for crosswell seismic is introduced. First, a model building method based on block units is used to build a crosswell seismic geological model. Then, the trial-ray method is used for ray tracing of the geological model. Finally, crosswell synthetic data are obtained. The results show that this forward modeling method based on block units can simulate complex geological structures with faults, pinchouts and so on. The iterate rays converge more quickly in simple models than in complex models. Crosswell seismic wave fields can be identified by crosswell seismic ray-tracing and crosswell synthetic data.

Key words: crosswell seismic, ray tracing, block-unit, model building, trial-ray method, forward modeling

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Seismic random noise suppression based on the discrete cosine transform. Lu Wen-kai¹. *OGP*, 2011, 46 (2): 202~206

This paper proposes a seismic random noise suppression method using the predictive filter in the discrete cosine transform (DCT) domain, and then evaluates its performance. In comparison with the discrete Fourier transform (DFT), DCT can represent seismic signals with fewer coefficients, i. e., DCT has superior energy compaction for seismic signal. That is why DCT can separate seismic signals from random noise better. The results from both synthetic and real data show that the proposed method achieves better performance for random noise suppression and signal preservation compared with the f - x prediction filter.

Key words: discrete cosine transform, predictive filter, F - X domain, random noise

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Amplitude-preserved multiple suppression based on expanded pseudo-multi-channel matching. Li Zhen-chun¹, Liu Jian-hui², Guo Chao-bin¹, Guo Shu-juan¹ and Zhang Chuan-qiang¹. *OGP*, 2011, 46 (2): 207~210, 231

The wave-equation-based multiple attenuation method mainly consists of two steps: multiple prediction and multiple matching subtraction. The effectiveness of multiple suppression depends on these two steps. Here an improved approach is introduced. On the basis of SRME and the expanded pseudo-multi-channel matching, we propose three strategies to achieve the multiple suppression in the condition of amplitude preservation: 1) Multiple prediction and matching according to orders; 2) Effective energy preserving before matching processing; 3) Using iterative short filter during matching. Sigsbee2B model test and real data processing show that this method is effective in improving the adaptive subtraction in multiple suppressions while primary amplitude well preserved.

Key words: multiple suppression, expanded pseudo-multi-channel matching, masking filter; high-order multiple, amplitude-preservation

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Predominant frequency band operator extrapolation to improve noise attenuation in f - x domain. Xiong Ding-yu^{1,2}, Qian Zhong-ping², Zhao Bo², Zhou Ya-tong² and He Zhen-hua¹. *OGP*, 2011, 46 (2): 211~216

Usually f - x prediction filtering seriously depends on S/N of original seismic data. A predominant frequency-band operator extrapolation for noise attenuation improvement in f - x domain is proposed in the work. In order to get dependable prediction operators of the lower S/N frequency band, the method, utilizing the relation of close frequency band prediction operators, predicts the lower S/N frequency band by prediction operators

of high S/N frequency band. In this instance, the precision of the prediction operator in the lower S/N frequency band is guaranteed. Consequently, high frequency effective signal in the lower S/N frequency band is protected.

Key words : f - x domain , predominant frequency band , prediction operator , S/N

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A 3-D curved-surface fitting and stacking method in time-space domain using compound orthogonal polynomial. He Xu-li^{1,2} , Liu Su-qin¹ and Tong Zhao-qi¹ . *OGP* , 2011 , 46 (2) : 217 ~ 220

Polynomial fitting can increase signal-to-noise ratio without damaging resolution. But the method can only be used in processing 2-D seismic data. In this paper, a 3-D curved-surface fitting and stacking method is introduced. It can separate and compound linearity fitting, hyperbola fitting and flexure fitting using decomposability of 3-D compound orthogonal polynomial. A 3-D seismic dataset is processed in offset domain by this method. High quality section is obtained. Processing results prove that the method can improve signal-to-noise ratio and resolution effectively.

Key words : time-space domain, 3-D curved-surface fitting, compound orthogonal polynomial, linear fitting, hyperbolil fitting, flexure fitting

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Analysis on inversion accuracy of near-surface model inversed by first break travelttime tomography. Li Yu¹ , Yang De-yi² , Deng Hui³ , Yan Rui¹ , and Chen Feng-yin¹ . *OGP* , 2011 , 46 (2) : 221 ~ 225

In order to improve the inversion accuracy of

near-surface model inversed by first break travel-time tomography, and then to enhance static corrections more effective, the paper discusses the impact of source depth and constraint velocity on the inversion accuracy. Based on typical synthetic near-surface model, we adopt analysis on the characteristic of ray paths from the source on the surface, the source below weathering and the source below sub-weathering. We discuss the impact of the minimum constraint velocity on the inversion of the weathering when source depth is below weathering. Furthermore, uphole time is involved to determine the minimum constraint velocity and a new method to determine the minimum constraint velocity, called auxiliary source, is also described. Finally the method is applied both to synthetic data and real seismic data and results show that the inversion accuracy is improved.

Key words : first break travelttime, tomography, inversion, near-surface model, source depth, constraint velocity

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Imaging by a joint tomography of direct wave travel-time and reflection wave travelttime in crosswell seismic and its application. Zuo Jian-jun^{1,2} , Lin Song-hui² , Kong Qing-feng² , Zhang Jian-zhong³ , and Shi Jun-jie³ . *OGP* , 2011 , 46 (2) : 226 ~ 231

The paper discusses a joint tomography of direct wave traveltime and reflection wave traveltime in crosswell seismic. Using direct wave traveltime and reflection wave traveltime between wells with well information such as slowness distributions and reflection interface positions, this tomography method benefits a good astringency. The damp LSQR arithmetic is applied in the tomography procedure. It can effectively improve de-noise ability.

Its application to the forward modeling proves its feasibility. Applications to field datasets indicate that high resolutions are obtained for both vertical and horizontal direction; and good velocity matching around the wells.

Key words : crosswell seismic, direct wave, reflection, tomography

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Theoretical study on characteristic of weak signal and its identification. Han Wen-gong¹, and Zhang Jun-hua². *OGP*, 2011, 46 (2): 232~236

Seismic weak signal is a real big challenge for seismic explorations. Based on amplitude characteristics of seismic weak signal in thick and thin layers, this paper analyzes the spectrum characteristics of seismic weak signal as well as the influence of noise on it. In addition, we conduct preliminary discussions about the detection and identification of weak signal using the singular value decomposition (SVD) and curvelet transform. The results indicate that: 1. It is basically impossible to detect weak signal by visual recognition when $S/N < 0.5$; 2. For thin reservoirs, the tuning thickness could be identified if the S/N is 2; 3. The spectrum of the weak signal involved in the adjacent strong reflection cannot show its characteristic; 4. Horizontal weak events mixed with noise can be effectively detected by the SVD method while non-horizontal weak events mixed with noise can be detected by curvelet transform.

Key words : weak signal, amplitude characteristics, spectrum characteristics, SVD, curvelet transform, S/N

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Missing seismic data rebuilding by interpolation based on Curvelet transform. Liu Guo-chang¹, Chen Xiao-hong¹, Guo Zhi-feng¹, Liu Hua-feng¹, and Gao Jian-jun¹. *OGP*, 2011, 46 (2): 237~246

Curvelet transform is suitable for nonstationary seismic data processing because it is multi-scale, multidirectional, and strictly localized. The compression attribute of Curvelet transform can be used for reconstruction of missing seismic data. In the paper, we first analyze the principle of missing seismic data interpolation using sparse transform. Then we discuss the difference between the interpolation methods with ℓ_1 -norm and ℓ_2 -norm restrictions in the inversion framework. We expatiate in detail on the interpolation method with ℓ_1 -norm restriction, which do not need sliding windows for processing nonstationary seismic events. We introduce the Projections Onto Convex Sets (POCS) algorithm into the interpolation using Curvelet transform. The threshold in POCS algorithm is chosen to be exponentially decreased, which is a fast convergence method in iterative inversion. Synthetic and real data examples show that the interpolation method using Curvelet transform can effectively rebuild missing seismic data.

Key words : seismic data, rebuilding, Curvelet transform, Projections Onto Convex Sets, L_2 -norm, L_1 -norm

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Wide-band B-spline wavelet with four parameters. Liu Lan-feng¹, Cao Si-yuan¹, and Wang Lu². *OGP*, 2011, 46 (2): 247~251

Based on the wavelet decomposition and its reconstruction theory, we propose here a method to reconstruct wide-band wavelets. Different seismic wavelets can be reconstructed in this way. In virtue of complex frequency B-spline wavelet, we form a wide-band B-spline wavelet with four parameters and deduce its analytic expressions both in the time domain and in the

frequency domain. The side lobes and phase numbers of the wide-band B-spline wavelet with four parameters can be easily adjusted through its parameter. In comparison with the Ricker wavelet and wide-band Ricker wavelet in the condition of the same main lobe equivalent frequency, the wide-band B-spline wavelet with four parameters not only has smaller side lobe but also has shorter non-zero time length. The synthetic result of wedge model indicates that the wide-band B-spline wavelet with four parameters has higher resolution and its parameters are easily adjusted. Therefore, it is a seismic theory wavelet more conveniently to be used in seismic data processing.

Key words : signal reconstruction, complex frequency B-spline wavelet, side lobe, instantaneous frequency, wide-band B-spline wavelet

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Analysis of absorption and dispersion characteristics of anelastic medium. Zhang Li-bin¹, Wang Hua-zhong¹ and Ma Zai-tian¹. *OGP*, 2011, 46 (2):252~258

Anelasticity of subsurface medium causes seismic energy absorption and phase-velocity dispersion and reduces the resolution of seismic image consequently. It has been one of the important objectives of seismic modeling and inversion. The micro-mechanism of seismic attenuation and dispersion is complicated and affected by many subsurface medium's environmental conditions. Based upon the Boltzmann superposition principle, the attenuation coefficient and phase-velocity dispersion equations of Kjartansson constant-Q model have been deduced systematically. The energy absorption and phase-velocity dispersion characteristics of eight anelastic models have been compared and analyzed completely. This research is contributive to study on the anelasticity of subsurface medium and related issues such as estimation of quality factor and inverse Q filtering.

Key words : anelastic medium, absorption and dispersion model, constitutive equation, Boltzmann

superposition principle

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A joint inversion combining the grid-search algorithm and the genetic algorithm under solution-domain constraints for microseismic events. Song Wei-qi¹, and Yang Xiao-dong¹. *OGP*, 2011, 46 (2):259~266

The grid-search method is simple, fast and can quickly determine a rough solution. But it is difficult to confirm the real solution due to the impact of first arrivals, velocity model and so on. The genetic algorithm adapts to first arrival completely and has strong global search ability. The search process can be complex, time-consuming and the accuracy of solution will be reduced greatly if search domain is set arbitrarily. Taking the advantages of these two methods, we put forward the grid-search and genetic algorithm joint inversion under solution-domain constraints for microseismic events. We discuss the forward modeling, the first arrival sensitivity and perforation information closely related to the inversion calculation. Applications of this method in both synthetic datasets and real datasets prove that the accuracy, the efficiency and the stability are obviously improved by the joint inversion method than the search inversion or the genetic algorithm inversion only.

Key words : grid-search method, solution-domain constraints, genetic algorithm, joint inversion, first arrival sensibility, computation.

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Application of the Diffusion Monte Carlo method to seismic inversion. Wei Chao¹, Zheng Xiao-dong¹, and Li Jin-song¹. *OGP*, 2011, 46 (2):267~271

Diffusion Monte Carlo method, an effective numerical simulation way for many-body system research in quantum mechanics, has strong nonlinear searching capability for getting global optimal solution. This paper introduces diffusion Monte

Carlo method from the domain of quantum mechanics to seismic inversion, which results show the feasibility of the method. On that basis, the inversion of real seismic data gets preferable result, which denotes that diffusion Monte Carlo method has successful application in seismic inversion, has some advantages for avoiding being trapped in local minimum and is suitable for nonlinear, multi-maximum geophysical inverse problem.

Key words : Diffusion Monte Carlo method ; global optimization ; nonlinear seismic inversion

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Blind source separation of picking first arrival based on second-order statistics. Li Yong¹, Chen Ming¹ and Zhang Jian-yue². *OGP*, 2011, 46 (2): 272~274

Noise reduction usually is conducted before first arrivals picking, which could damage effective signals. This article proposes an algorithm of blind source separation based on the second-order statistics. The method focuses on noise separation rather than noise removal. So there are no harms to effective signals. This idea might provide a new way for noise reduction. The algorithm of blind source separation based on the second-order statistics is applied to seismic data. The results show that the algorithm is effect, noises are separated and removed, and accurate first arrivals are picked up.

Key words : second-order statistics ; gradient ; blind source separation

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Lithofacies identification model for deep high-porosity and high-permeability carbonate reservoir and its applications: Examples in Puguang Gas Field. Huang Han-dong^{1,2}, Luo Qun³, and Zhao Di¹. *OGP*, 2011, 46 (2): 275~280

It is very difficult to predict of deep high-po-

rosity and high-permeability reservoirs in Puguang Gas Field by seismic data due to their complex lithology, lithofacies and strong anisotropy. Based on logging data of 10 wells in the gas field, two categories of reservoirs exists, which include nine kinds of reservoirs, among of which oolite subfacies, sand-gravel subfacies and reef subfacies are beneficial reservoir types of high porosity and high permeability. In this work, a lithofacies identification model for deep high-porosity and high-permeability reservoir is proposed based on high-accuracy inversion. Combining lithofacies and regional sedimentary setting analysis, external feature, internal structure and relationship with surrounding rocks, high-porosity and high-permeability carbonate reservoirs in Puguang Gas Field are predicted for further exploration.

Key words : deep layer ; carbonate ; high-porosity and high-permeability reservoir ; identification model ; Puguang Gas Field

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Applications of amplitude spectrum gradient for reservoir evaluation in WC project. Wei Xiao-dong¹, Zhang Yan-qing¹, Cao Li-li¹ and Wang Yan-nan¹. *OGP*, 2011, 46 (2): 281~284

Seismic amplitude spectrum gradient presents a rate of reflection amplitude versus frequency in the effective band, which highlights variation of seismic data amplitude with different frequency. So it reveals variation of reservoir permeability. The paper discusses computations of amplitude spectrum gradient and its applications for prediction of plane distribution of high-permeability sandstones in WC exploration project. Results show that this approach successfully predicts lithologic traps and structural-lithological compound traps and deline-

ates a series of potential areas.

Key words : seismic data, amplitude spectrum gradient, reservoir evaluation

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Time-lapse seismic applications in China offshore gas fields. Zhou Jia-xiong^{1,2}, Xie Yu-hong², Chen Zhi-hong², Martin Riviere³, Liu Wei-wei² and Sun Yue-cheng². *OGP*, 2011, 46 (2):285~292

The paper presents time-lapse seismic practices in YC13-1 and DF1-1, two offshore gas fields in South China Sea. The drained blocks and residual gas distribution of YC13-1 Gas Field are predicted by time-lapse seismic data interpretation combined with core measurement. Based on YC13-1 time-lapse seismic study, a systemic time-lapse seismic study of DF1-1 Gas Field is conducted. In the study, several difficulties have been overcome: dataset matching in time-lapse data processing, calibration of time-lapse data with well information, and pressure decrease in blocks while the gas saturation and the gas water contact unchanged. The time-lapse seismic results are applied to update depletion plan, and the new data show it will get better recovery and better benefits.

Key words : YC13-1 Gas Field, DF1-1 Gas Field, core measurement, time-lapse processing, time-lapse interpretation

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Fluid forecast based on multi-scale geophysical data.

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At present, prediction of remaining oil distribution for oil field development is mainly performed using reservoir numerical simulation. In this work, a joint inversion is proposed for fluid

forecast using geophysical data as a constraint by integration with conventional methods of reservoir numerical simulation. Results from this process can be consistent with fluid flow and spatial geophysical attribute characteristics. This could be an effective schema for remaining oil distribution characterization in mature fields. In this paper, we use the static parameters of Yong 3 fault block such as P-wave and S-wave logging data, permeability, porosity, lithofacies etc, and combine with dynamic parameters in development for application. First, we calibrate the rock model with logs, such that the template for geophysical responses on different dynamics states can be created. Then we project the pre-stack seismic inversion data onto numerical reservoir simulation grid. The saturation at each grid can be estimated using the calibrated template. Finally, the fluid spatial distribution can be mapped by integration of reservoir numerical simulation and seismic pre-stack inversion data.

Key words : rock model; template, pre-stack seismic inversion; simulation model; fluid prediction

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Seismic subtle interpretation of complex minor fault in Yangxin Sub-sag. Ran Huai-jiang¹, Liang Xing², Chen Fang-hong³ and Zuo Chen-mei¹. *OGP*, 2011, 46 (2):299~303

Yangxin Sub-sag is located in Baiju depression of Subei Basin with complex fracture systems, dense faults and small traps. Early explorations showed that Yangxin Sub-sag seemed to be good prospects for oil and gas exploration, but the structure delineation was not confirmed. Starting from studying fracture system, we identify and describe minor faults by multi-attribute extraction from multiple sections, multi-direction profiles. Using this seismic subtle interpretation method, the structure delineation has been improved in Yangxin Sub-sag.

Key words : seismic subtle interpretation, complex

fault, seismic attribute, small rift, small block, minor fault, Yangxin Sub-sag

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Applications of facies-controlled nonlinear random inversion for carbonate reservoir prediction in Block A of Amu-darya Basin. Zhang Zhi-wei¹, Wang Chun-sheng¹, Lin Ya-ping¹, Zhou Tian-wei¹, Huang Han-dong², and Zhao Di². *OGP* .2011 .46 (2):304~310

Focus on carbonate reservoir characteristics sensitive to P-wave attributes in Block A of Amu-darya Basin, we picked the velocity, amplitude and frequency from 3D seismic data constrained by geological and logging data, and then we applied facies-controlled nonlinear random inversion for carbonate reservoir prediction in Block A of Amu-darya Basin. The following observations were obtained. First, carbonate rocks have bedded features in Block A of Amu-darya Basin. Two strong reflections were found at the top and the bottoms of carbonate rocks. Reflections are continuous in intervals. Carbonate reservoirs are mainly porous with few caves but very few fractures. Secondly, carbonate reservoirs are mainly shown as low velocity zones, located the southeast and northeast in the study area. Low velocity zones on the structure crest are favorable drilling location. Thirdly, different lithology is shown as different velocity on inversion sections. The velocity of the upper clastic rock is the lowest, and the velocity of the anhydrite and salt rocks in the middle is higher than the upper clastic rock. And the velocity of the underlying clastic rock is higher the upper one. The velocity of the carbonate reservoir is highest. Two wells drilled on the favorable location predicted by the facies-controlled nonlinear random inversion produce large-duty gas. This demonstrated that the facies-controlled nonlinear random inversion is

accurate and reliable.

Key words : Amu-darya Basin, carbonate, reservoir prediction, facies-controlled, nonlinear, random inversion

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Large-array 3D-VSP technique applied to Daqing Oil Field. Li Yan-peng^{1,2}, Chen Yuan-zhong², Xu Gang², Hao Jian-bo³ and Xu Zheng-shun⁴. *OGP* , 2011 , 46 (2):311~316

Deep seismic events are hard to be tracked and the inner structures of reservoir are hard to be identified in XJWZ of Daqing Oil Field because the formation of volcanic gas reservoir and its spatial distribution are very complicated. With large-array 3D-VSP seismic, high precision images and some direct reservoir parameters can be acquired around the observation well. This paper shows a case study of 160-level 3D-VSP survey in Well XS21-1 of Daqing Oil Field. An objective oriented geometry and survey parameter optimization were introduced in data acquisition aspect. For data processing, we adopted a series of distinctive techniques including high precision auto-picking of 3D-VSP first breaks, vector wavefield separation, anisotropy parameter inversion, ray tracing-based VSPCDP mapping and migration. Finally, processing results were analyzed and interpreted. Results indicate that large-array 3D-VSP can be used for reservoir subtle interpretation effectively.

Key words : large-array 3D-VSP, VSPCDP mapping, anisotropy, wavefield separation, VSP and surface seismic joint exploration

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Neopaleozoic tectonic evolution and hydrocarbon analysis in Bamai-Tazhong area, Tarim Basin. Guo Qian^{1,2}, and Pu Ren-hai^{1,2}. *OGP*, 2011, 46(2): 317~325

From a paleostructure map of Bamai-Tazhong area in Tarim Basin based on drilling information and seismic data, and through the restoration of Neopaleozoic deposit thickness in Bamai-Tazhong, this paper elaborates that hydrocarbon, after entering reservoir, migrated from the ancient structure nose shaped salient to pitch up direction, and that the hydrocarbon migration, accumulation and dissipation were revealed after leaving source rocks or source rock area. The observations are obtained as follows: 1. The ancient uplift and depression pattern of Bamai-Tazhong in Neopaleozoic period was very different from nowadays, these two uplifts were preliminarily formed during Neopaleozoic, and had the NW extension direction during Carboniferous. The high point of Tazhong uplift was further west than the present time. Hetian River area between these two uplifts is now a low uplift, but it used to be an ancient depression and saddle. The SW Maikit slope was a WE depression which extended deeper from west to east. 2. The top surface tectonic evolution of Donghe sandstone show that oil and gas generated in Manjiaer depression migrated to north before latest cretaceous, failed to accumulate in Tazhong uplift. Hydrocarbon migrated to south after neogene and was captured into reservoirs at the No.1 and No.10 high traps in Tazhong uplift, while low structure traps in the south slope of Tazhong uplift could not get hydrocarbon. This probably is the reason for a few dry holes. 3. The north Maikit slope and Hetian River low uplift were migration and accumulation areas

of multi-struture period. The high structure and the north side of Tazhong uplift were provision and accumulation areas to Manjiaer depression during himalayan period. The eastern area of Tazhong uplift was the final migration oriented area and also the updip pinch-out zone of Donghe sandstone, which consists of multiple sets of reservoirs, a favorable exploration area in Bamai-Tazhong.

Key words: Tazhong uplift, Bachu uplift, Maikit slope, Neopaleozoic, tectonic evolution, erosion thickness restoration, hydrocarbon migration

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Computations of ramp turn-off response of a large fixed rectangle transmitting loop. Liu Zheng^{1,2} and Yang Sheng². *OGP*, 2011, 46(2):326~330

In order to accurately calculate all-time apparent resistivity, the analytic formula of the transient electromagnetic response for ramp turn-off of a large fixed rectangle transmitting loop is derived in the article. During calculations of apparent resistivity, effects of ramp turn-off can be revised and approximations of numerical integration can be avoided. So the calculation precision will be improved greatly and computer time will be less. Calculations using the analytic formula show its special advantage by theoretical practical examples.

Key words: transient electromagnetic method, large fixed rectangle transmitting loop, induced electromotive force, ramp turn-off

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