

ABSTRACTS

Seismic exploration for strati-lithologic reservoirs.

Xiong Zhu¹. *OGP*, 2012, 47 (1): 1~18

This paper discusses a few specific points on seismic exploration for strati-lithologic reservoirs. Firstly we review the general idea of seismic technology for strati-lithologic reservoir identification. Secondly 8 issues of seismic data acquisition and 10 issues of seismic data processing are illuminated in order to obtain a good 3D data cube. Then a set of interpretation approaches for strati-lithologic reservoirs are demonstrated including seismic inversion, attribute analysis, petro-physics analysis, geologic model building, and seismic forward modeling. Finally we conclude comprehensive geological researches on seismic data. The author's observations are given and these could be meaningful for strati-lithologic reservoir identification.

Key words: strati-lithologic reservoirs, seismic technology, 3D data cube, seismic data processing, comprehensive geological researches on seismic data, reservoir attribute prediction and characterization

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Elastic wavefield simulation using separated equations through pseudo-spectral method. Tang Xiaoping¹, Bai Chaoying² and Liu Kuanhou¹. *OGP*, 2012, 47(1): 19~26

Based on the first order wave equation separation, the similar formula for second-order wave equation separation method is deduced in this paper, which has a simple form and easy derivation over the original one. The separated first- and second-order wave equation is solved with regular and staggered-grid pseudo-spectral method. As a result, the P and S wavefield can be obtained directly. Comparing with the first-order and the second-order pseudo-spectral method, and separation and non-separation method, our results show that the first-order and second-order pseudo-spectral methods have same effect in wavefield simulation,

but first-order one is good at the traveltimes picking, while the second-order one is advantageous over the first-order one in terms of the wavelet amplitude preservation, waveform protection and wavefield separation. The wavefield separation simulation method has more flexible usage in computation projection.

Key words: wavefield simulation, first-order pseudo-spectral method, second-order pseudo-spectral method, staggered grid, regular grid

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Beamlet prestack depth migration on crosswell data. Ye Yueming¹, Li Zhenchun², Wu Rushan³ and Zhuang Xijin¹. *OGP*, 2012, 47(1): 27~31

We can get better complex structure image from prestack depth migration of surface seismic data, but it lacks of resolution when imaging in some area with thin layers. Cross-well acquisition system has little effect from the surface and has higher frequency information, which can get higher resolution image. Prestack depth migration based on one way wave equation can adapt to area with strong velocity variation. However, this conventional migration method cannot be directly used for crosswell data. In this paper, we perform the cross-well prestack depth migration with the thought of wave field accumulation gradually based on the directly downward continuation. The beamlet migration operator was introduced which has localized reference velocity. The localized reference velocity reduces the perturbation velocity and improves the calculation accuracy. The test of complex crosswell model migration has proved the validity and effectiveness of our method. The faults are clearer and migration noise was better suppressed.

Key words: crosswell seismic, prestack depth migration

gration, beamlets, high resolution

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Seismic interferometry in seismic whiling drilling data processing. Huang Weichuan¹, Ge Hongkui¹, Wu Hezhen¹, Han Laiju² and Wei Maoan². *OGP*, 2012, 47(1): 32~36

After brief review of the interferometry theory and relative algorithm, this paper focuses on the discussion of seismic interferometry processing and migration imaging with seismic whiling drilling (SWD) data. Seismic information excited by the drilling bit is extracted from strong noise data by F - K filter, interferometry and vertical stacking process. And then it is well imaged by Kirchhoff migration and autocorrelation migration. Combined with surface seismic stack sections around Well Fan158 in Shengli Oilfield, characteristics of wave groups of SWD image are analyzed. Results show that deconvolution interferometry and autocorrelation migration work pretty well in SWD data process.

Key words: seismic interferometry, seismic whiling drilling, Kirchhoff migration, autocorrelation migration, deconvolution interferometry

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Denoising by correlative stacking via L_2 norm. Zhang Henglei^{1,2}, Liu Tianyou^{1,2} and Hu Xiangyun¹. *OGP*, 2012, 47(1): 37~45

This paper concentrates on a method of correlative stacking to suppress seismic random noise. In examining the basis of the traditional coherence algorithm, we proposed a denoising method by weighted stacking via neighborhood correlation

(WS-NC), namely using L_2 norm which also called Euclidean distance to estimate the similarity between two neighborhoods. Then we apply the Gauss function on Euclid distance as the weighting coefficients when stacking neighborhood points. So the random noise can be identified from region and suppressed in the local, while the amplitude of effective reflected wave can be well maintained. Applications on both synthetic data and actual seismic data show that the new method eliminates the noise portion more efficiently and retains a greater amount of geologic data, and it may be an effective method for seismic data with low S/N ratio.

Key words: random noise, correlative stacking, L_2 norm, Euclid distance-Gauss function

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A processing method for high fidelity and wide frequency band seismic data collected by digital sensors. Chen Zhide¹, Guan Xin¹, Li ling¹ and Zhang Jing¹. *OGP*, 2012, 47(1): 46~55

Compared with seismic data collected by analog geophones, seismic data collected by digital sensors have an obvious priority, such as amplitude of high fidelity, rich high-frequency components. But they also have contaminated by serious noises. It is a valuable to find proper processing techniques for the seismic data collected by digital sensors to obtain high resolution images. In order to provide high quality images for oil development during high water cut stage, a 3D3C seismic survey was carried out in Lamadian area. Four kinds of data processing techniques have been developed, i. e. noise attenuating during different stages, data-driven amplitude recovery, phase correction and amplitude compensation guided by Q value before deconvolution, and surface-consistent spiking deconvolution. The results of sandstone identification by seismic data and drilling data have proved

the advantages of the processing approaches of seismic data collected by digital sensors. The sandstone boundaries are clearly delineated.

Key words: digital sensors, high fidelity, wide frequency band, noise attenuation, amplitude compensation, spiking deconvolution, lithology identification

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Seismic denoising based on the modified particle swarm optimization-independent component analysis. Zhang Yinxue¹ and Tian Xuemin¹. *OGP*, 2012, 47(1): 56~62

A modified independent component analysis (ICA) approach based on the chaos particle swarm optimization (PSO) is proposed in this paper in order to improve prestack seismic denoising on the basis of the fixed step size ICA. This method utilizes the chaos PSO algorithm to adjust the step size function of relative gradient ICA, and it can reduce the residual error of ICA. On the other hand, a nonlinearly decreasing inertia weight (NDIW) is proposed to improve the capability of global and local search of PSO. The trial results for synthetic and shot gather data show that the proposed ICA method works pretty well on removing random noise with very little seismic signal loses compared to other approaches. In addition, the proposed method can obtain high signal-to-noise ratio (SNR) data.

Key words: modified PSO-ICA, denoising processing, independent component analysis, variable step size, particle swarm optimization, inertia weight

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A high order optimized traveltimes algorithm and its applications in seismic imaging. Wang Jianli¹, Fang Zhengmao², Yang Changchun², Wang Yanchun¹, Liu Wenlei³ and Zhen Hongmei⁴. *OGP*, 2012, 47(1): 63~67

Based on the Snell's law, we propose in this

paper a new algorithm to calculate the seismic traveltimes using the higher order optimum Taylor series. A numerical example shows that this method has higher accuracy in calculating the travel-times both in the positive and negative gradient velocity models than the conventional method. We use this method for prestack time migration of seismic data acquired in the complicated mountain area of the Northeast Sichuan and obtain the agreeable results.

Key words: seismic traveltimes, prestack time imaging, Taylor series, the Snell's law

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The effects of seismic data conditioning on pre-stack AVO/AVA simultaneous inversion. Zhang Jinhai^{1,2}, Zhang Yuanyin^{3,4} and Sun Zandong^{3,4}. *OGP*, 2012, 47(1): 68~73

Seismic data used for pre-stack inversion should have high quality. To improve the seismic data quality of Xinglongtai area, Liaohe western sag, and make the AVO anomaly characterizes of gathers same as synthetics, this paper employs three conditioning processes—multiple removal, random noise attenuation, and gather flattening. After data conditioning processing, a comparison of wavelets extracted separately from the raw and conditioned angle stacks found amplitude and phase spectra to be much more stabilized in 0~42Hz. The seismic/synthetic inversion residuals of target area shows at least 20% drop in amplitude. Finally, the AI/SI cross-plot shows a much more compact signature that is more available for lithology discrimination and precise reservoir prediction. All these improvements show the importance of data quality on pre-stack inversion.

Key words: western sag, multiple attenuation, da-

ta conditioning processing, pre-stack inversion, reservoir characterization and prediction

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Study on petrophysical properties of volcanic reservoir in the third member of Yingcheng Formation in Songliao Basin. Guo Hongyan^{1,2}, Yun Meihou³, Ai Yinshuang¹ and Nie Yan³. *OGP*, 2012, 47(1): 74~81

Volcanic oil and gas reservoir prediction is one of the hotspots of the seismic reservoir prediction research. It is the key and foundation to research the petrophysical properties of volcanic reservoir for using seismic reservoir prediction successfully. Based on well logging interpretation results and core experimental data and logging data from eleven wells in the block of SS2-1 well in Songliao basin, it is studied in detail for seismic properties of volcanic reservoir in the third member of Yingcheng Formation. The results show that volcanic rock body can be recognized by using the difference of seismic reflection characteristics, but it is very difficult and uncertain to distinguish different volcanic rock. Because compressional wave impedance and density have good statistical regression relationship with porosity for the volcanic reservoirs, it is feasible to predict porosity using seismic data, but it is difficult to predict permeability. The elastic properties of gas, water and dry reservoir have marked differences, so it is feasible to distinguish the gas or water reservoir and the dry layer, but to estimate accurately gas saturation is very difficult.

Key words: Songliao Basin, the third member of Yingcheng Formation, volcanic reservoir, petro-

physical property, well logging data

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Delta fringe line recognition based on seismic matching pursuit instantaneous spectral characteristics. Zhang Fanchang¹, Li Chuanhui¹ and Yin Xingyao¹. *OGP*, 2012, 47(1): 82~88

This paper first presents the principle of seismic signal matching pursuit decomposition and the computation of high precision instantaneous spectra, then proposes a new method for wedge edge interpretation with its instantaneous spectral features in time-frequency domain by analyzing the time domain and frequency domain responses of the wedge edge. Actually, the delta fringe deposit thickness is not the same along different direction. In this situation, this paper introduces kernel principal component analysis method to integrate the effective information of pinch-out line contained in the original dominant instantaneous spectral components. Therefore, the whole face of pinch-out line can be fully recognized and the non-uniqueness in delta fringe interpretation is extremely reduced.

Key words: matching pursuit, instantaneous spectra, pinch-out line, kernel principal component analysis, thin layer reflection

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Instantaneous spectral difference anomaly extraction on prestack multi-angle gathers and its application. Chen Xuehua^{1,2}, He Zhenhua^{1,2}, Zhao Yan² and Zhong Wenli³. *OGP*, 2012, 47(1): 89~94

Since seismic reflection amplitude (or energy) and its low frequency components of the fluid-filled reservoirs on different angle stack gathers vary sig-

nificantly, this paper presents a new fluid identification method using seismic low frequency components on prestack different angle stack gathers. The method first carries out instantaneous spectral decomposition of both near-angle and far-angle stack gathers, and then introduces an instantaneous spectral difference extraction formula by the low frequency spectral components. Finally a fluid identification section is obtained. Applications of the method on both offshore and onshore seismic data are given respectively in the paper. The results show that the detected hydrocarbon anomaly is consistent with the actual drilling.

Key words: multi-angle stack gathers, instantaneous spectral decomposition, low-frequency difference anomaly extraction, amplitude versus offset, fluid identification

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Application of 90° phase data in lithologic interpretation. Chen Chunji¹, Feng Shimin², Mo Aling³, Li Jianhua¹, Xing Hongge¹, Liu Yaqin¹, Wang Guiyan¹ and Zhen Hongmei⁴. *OGP*, 2012, 47(1):95~99

This paper briefly describes the principle of 90° phase data interpretation. Through the synthetic data we success to identify seismically thin beds in lithologic interpretation of 90° phase data, and describe the implementing procedure of 90° phase shift method. For real seismic data, we use the Wiener-Levinson mixed phase extraction method to estimate the seismic wavelet phase and use the phase shift method to convert the mixed phase to zero phase, and then convert to 90° phase. Finally we propose an idea to interpret thin beds by application of 90° phase data. Through the practical applications, we can confirm the advantage of 90° phase data in thin-bed interpretation.

Key words: 90° phase wavelets, lithologic interpretation, trace integration

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GLCM parameters in fluvial texture analysis. Wang Zhiguo¹, Yin Cheng¹, Lei Xiaolan², Gu Faming³ and Wu Xiaohua⁴. *OGP*, 2012, 47(1): 100~106

Channel texture is an acoustic expression of a fluvial facies via seismic amplitude fluctuations. The Gray Level Co-occurrence Matrix (GLCM) attribute has been proved to be a promising method for seismic texture analysis. As we try to extract seismic texture attributes, however, it is a big uncertainty how to select the optimal GLCM parameters which will impact the final estimated seismic texture results and also affect the computing time. In this paper, we study the relationship between GLCM parameters and final seismic texture results to simplify the computation of GLCM. We build an ideal synthetic channel reservoir model which is derived from a modern meandering river. Then we simulate a noise-free post-stack seismic data using 3D Gaussian beam approach. With the synthetic channel model data, we will show how to select the four key GLCM parameters including the gray levels, the size of moving window, and the distance and direction of gray pairs. Selecting various combinations of these four key parameters, we extract four GLCM secondary statistical measurements (Energy, Entropy, Contrast, and Homogeneity). Based on theoretical equations and horizontal slices of texture, we ultimately get a proper co-occurrence matrix parameter for fluvial reservoir from our synthetic channel model. For energy and entropy, the number of gray levels is lower. For contrast and homogeneity, the number of gray levels is higher. The size of moving window is smaller

than the half of the size of geological target. The distance of gray pairs is usually 1. And we usually represent repetitive patterns of gray pairs at angles of 0° , 45° , 90° and 135° to the axes. At last, we apply our method on the field data from Bohai Bay, China. This real seismic example shows that GL-CM is an effective method for accurate and reliable channel texture measurements.

Key words: seismic texture, Gray Level Co-occurrence Matrices, gray level, window size, channel model

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Application of spectral decomposition in deep tight conglomerate reservoir prediction. Song Xiaowen¹, Ma Shizhong¹, Qin Qiuhan¹, Shu Ping², Wen Huijian¹, Zhai Shengnan² and Wang Tao². *OGP*, 2012, 47(1): 107~114

Gas reservoirs from the Member 4 of Yingcheng Formation in Xujiaweizi Depression were developed in early Cretaceous lacustrine rift basin and they are characterized by low porosity and low permeability, high thickness variation and high heterogeneity. Therefore they post a challenge on exploration and exploitation. In the study area, the Member 4 of Yingcheng Formation was penetrated by 96 boreholes, and DST was conducted in 21 wells. Analysis of seismic data shows the attenuation of frequency spectrum for the gas bearing conglomerate reservoir in the Member 4 of Yingcheng Formation. With spectral decomposition, gas saturation in the tight conglomerate reservoir in the Member 4 of Yingcheng Formation has been tested. Furthermore a classification is made based on different characteristics in spectral

attenuation, and a positive correlation is found between spectral attenuation angle and gas production. This method has been applied to the Member 4 of Yingcheng Formation in the places where no well data is available, and the predicted distribution of favorable reservoir zone coincides with other geological evidences observed, e. g. high gas production rate agrees with high secondary dissolution high-porosity zones.

Key words: spectral decomposition, tight conglomerate reservoir, gas detection, spectral attenuation, gas production, Xujiaweizi

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The regional multiple seismic attribute quantitative reservoir prediction method based on sedimentary characteristics. Zhang Xuejuan¹, Lu Shuangfang¹ and Jia Chengzao². *OGP*, 2012, 47 (1): 115~120

Conventional multiple seismic attributes quantitative reservoir prediction method are fast and effective. However the accuracy of this method would decrease if the study area is large and depositional environment is complex. To this end, the paper proposes a quantitative reservoir prediction method by multiple-seismic-attributes based on dividing the study area to different regions by depositional characteristics. Firstly, the study area is divided into different regions according to their depositional characteristics by seismic waveform classification, and then linear fit is progressed between multiple seismic attributes and reservoir information in different regions, finally, fitting results of different regions are synthesized as the predicting results of reservoir information in the whole area. The reservoir prediction of Dengloulou formation in Xujiaweizi area, east of Daqing placanticline in the north of Songliao Basin, was made. The sandstone data of 104 wells and 7 optimized seismic attributes were used, the fitting degree was only 0.48 by the gradual linear regression

method, which was increased to 0.83 by the multiple seismic attributes quantitative reservoir prediction method based on dividing regions according to sedimentary characteristics, at the same time the predicted results agreed with the sedimentary laws and geological knowledge.

Key words: sedimentary characteristics, seismic attribute, reservoir prediction, multiple regression, seismic facies

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Seismic sub-volume coherence and image synthesis technology for identifying complex anomalous geological body. Kong Linghong¹, Yuan Zhiyun¹, Lin Yaping¹, Zhou Tian-wei¹ and Wang Zhen¹. *OGP*, 2012, 47(1): 121~125

Seismic sub-volume coherence and image synthesis technology thinks 3-D seismic sub-volume data of any size as the basic computational unit. This technology characterizes the change of geophysical parameters between sub-volumes by multi-operator method. It achieves high-resolution and multi-information detection of the correlation among seismic attributes, dip and azimuth information and has the characteristic of the small average effect. Therefore it is more sensitive to weak variations of the seismic data. It increases apparent resolution of the volume by displaying synthetically coherence, dip and azimuth attributes and describes more clearly distribution of small faults or cracks and characterizes quantitatively the border of complex geological anomalous body. The thesis predicts effectively the distribution of the cracks of the buried hill reservoirs in Block A and the width of the meandering rivers in Block B by this technology.

Key words: complex geological anomalous body, volume attribute, sub-volume coherence, image synthesis

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Predrill prediction of formation pressure using seismic data in deep-water area of Baiyun Depression, northern South China Sea. Guo Zhifeng¹, Liu Zhen¹, Lv Rui¹, Liu Guochang¹, Zhang Gongcheng² and Shen Huailei². *OGP*, 2012, 47(1): 126~132

Deepwater area of northern South China Sea is featured by sparse well controls, shallow depth of drilling and difficulty of getting precise formation velocity. Considering the unique conditions in this area, this paper first improves models for pressure computation and extracts formation velocity, then discusses how to build precise computation models and how to obtain high-quality seismic absolute velocity, finally presents a method on predrill prediction of formation pressure using seismic data. A tendency prediction model for formation pressure has been improved through compressibility factor, a low frequency velocity model has been set up, and a relative velocity has been extracted by means of color inversion. Then seismic absolute velocity is acquired by compounding these two velocities. Ultimately, with the new calculation model and high-quality seismic absolute velocity, predrill prediction of formation pressure has been conducted at Baiyun depression. Testified by measured pressure, the predicted results turn out to be with high-precision. Our study shows that hydrostatic pressure develops in Zhuhai Formation and Zhujiang Formation, high amplitude overpressure develops in Paleogene at Baiyun Depression. Overpressure system would provide strong power for hydrocarbon upward migration.

Key words: deep-water area of northern South China Sea, formation pressure prediction, seismic absolute velocity, color inversion, compressibility factor

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Seismic sedimentary facies study based on high-resolution sequence framework: A case study on sequence Sqd₂ in Liaozhong Depression. Wu Wei¹, Lin Changsong², Zhou Xinhui³, Lai Weicheng³ and Wang Jun³. *OGP*, 2012, 47(1): 133~141

Regarding the Dongying clastic formation of Liaozhong Depression, high-resolution sequence and seismic sedimentary studies were utilized to describe sedimentary facies in order to disclose the distribution and controlling factors of the sedimentary system. The study results show that the strata of Dongying formation in Liaozhong Depression could be divided into three third-order sequences (Sqd₁, Sqd₂ and Sqd₃). Two fourth-order sequences in the sequence Sqd₂ could be identified by tracing a set of regressive boundaries. Based on seismic interpretation combined with logging characteristics, the seismic facies of delta, braided delta, turbidite fan were identified. Turbidite fan accompanying delta was rich in mud, while accompanying lacustrine turbidite fan was rich in sand. The boundary of sedimentary deposit could be identified by extracting seismic attribute. Distribution of sedimentary facies of fourth-order sequences could also be dominated by water system, ancient landform, relative lake level change and palaeoclimate.

Key words: Liaozhong Depression, Dongying formation, fourth-order sequences, turbidite fan, delta, braided river delta

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Reservoir prediction by sequence controlled at east slope reservoir of Chengdao offshore oil-field, Shengli. Wang Shaozhong¹ and Zhou Hongke¹. *OGP*, 2012, 47(1): 142~149

Dongying Formation at east slope reservoir of Chengdao offshore oil-field of Shengli Oilfield imbeds deeply, its facies change quickly and usually

have little difference of velocity with enclosed rock. So it is difficult to identify and calibrate single sandstone based on available 3D seismic data. And the distribution of reservoir cannot be found. In this paper we present our interior interface identification of Dongying formation cycle combined with drilling, logging and seismic data. Dongying formation cycle is divided into four sequences: S1, S2, S3 and S4. According to seismic wave group characteristics of sedimentary facies in Dongying formation, the paper reviews reservoir prediction based on seismic combined with geological information. The main procedures include sequence classification and interpretation, seismic facies interpretation, sedimentary body time window definition, reservoir prediction by clustering analysis without well controlled, and reservoir plane prediction with well controlled. With these integrated approach, good results are achieved in reservoir prediction in this area.

Key words: Chengdao offshore oil-field, Dongying Formation, cycle, sequence control, seismic facies, reservoir predicting

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Analysis of sequence and lithologic traps by seismic sub-layer correlation. Yang Ling¹, Bao Zhidong¹, Chen Kaiyuan², Li Jinbo³ and Zhang Peiyuan⁴. *OGP*, 2012, 47 (1): 150~156

In order to divide exactly seismic sequences of Qigequan formation and understand structural features inside these sequences in Sanhu area of Qaidam Basin, seismic sub-layer correlation is used to process and interpret seismic data. Combining with the Wheeler domain transformation map of seismic sub-layers, core data, well logging data and analysis test data, Qigequan formation is subdivided into five sequences from the bottom to the top, and the identification marks of sequence boundaries and flooding surfaces are determined. Each Qigequan formation sequence which has no obvious breaks is comprised of lacustrine transgressive system tract and lacustrine regressive system tract. And the la-

lacustrine transgressive system tracts are mainly characterized by retrogradation sequence while the lacustrine regressive system tracts mainly characterized by progradation sequence. Then the sequence mode of the research area is proposed. Combining with the updip pinchout of seismic sublayers, sandbody correlation and structural analysis, our study points that the lithologic traps of work area mainly distribute in eastern Taijinar, eastern Seniehu, western Tuofengshan uplift area and northern Tuofengshan, southern Seniehu, western Salt Lake slope area.

Key words: Qaidam Basin, Sanhu area, Qigequan group, sequence stratigraphy, seismic sub-layer correlation, lithologic trap prediction

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Seismic interpretation in Kunbei area of Qaidam Basin. Guan Junya¹, Li Hongge¹, Shen Ya¹, Chen Haiqing¹, Wang Guanghua¹, Qu Yanwei¹ and Tan Wei¹. *OGP*, 2012, 47 (1): 157~165

The geologic structure of Kunbei area of Qaidam Basin is discovered through interpretation of amount of 2D and 3D seismic data. The structural features and details are implemented using prestack depth migration and interpretation. Commercial pool are found from Q16 and other wells using sequence stratigraphy. The result indicates that the structural framework of Kunbei area shows north-south zonation and east-west segregation, and three tectonic units including Qiexi slope belt-Qiekelike sag-Wudong slope belt, southern piedmont sag belt and central Kunbei fault-step belt are divided by the first-order faults. The upfaulted block faults of the Kunbei fault with mainly SN or NE or NW strike are more broken nearby the ma-

jor fault and a large number of small faults around. Stratigraphic overlap trap in Lulehe group (E_{1+2}) of Q16 well zone is found. The glutenite of lake system tract is mainly reservoir section and a more stable mudstone with 20~40m thick nearby the maximum flooding surface is regional cap rock. All of these are conducive to form the strati-lithologic trap. Using hydrocarbon detection technology, it is found that the main oil Lulehe group (E_{1+2}) is located near the Q163 well. Prospective oil-bearing area of Q16 well is 33km². A 12km² new oil-bearing area located in the east of Q15 well is found. In short, prospective oil-bearing area by hydrocarbon detection is consistent with drilling results.

Key words: Qaidam Basin, Kunbei area, geologic structure, fault characteristic, strati-lithologic trap, seismic interpretation

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An architecture design of cloud computing service platform for oil exploration. Peng Ying^{1,2}, Wan Jianhua¹, Song Jian² and Wu Nan^{3,4}. *OGP*, 2012, 47(1): 166~172

The rapid advancement of petroleum exploration technology has greatly increased the amount of data storage and operation, which may require huge investment in computer and specialty software. One of the efficient solutions is to develop a petroleum exploration software service platform. This article demonstrates a model design based on cloud computation which is called middle ware service model of storage computation architecture (SCAM2). It can solve theoretically the problem of cooperation between storage and computation existed in the petroleum exploration oriented cloud computation service. This will lead the share of hardware and software used in petroleum exploration, the reuse of common ware, design and description of service client and provider of cloud computation.

Key words: oil and gas exploration, cloud computing, service platform, share, reuse, software as a service technology

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Two-dimensional wavelet transform to identify fractures in imaging logging. Zhang Xiaofeng¹ and Pan Baozhi². *OGP*, 2012, 47 (1): 173~176

Imaging logging usually gives an accurate intuitive response of fractures. This paper discusses two-dimensional wavelet transform for conductivity curve of imaging logging. The conductivity curve of imaging logging is decomposed by wavelet transform, and the relationship between decomposed signals and fracture are found out. The absolute values of the decomposed horizontal and vertical signals are added and then they are re-mapped to binary (fracture is 1, and no fracture is 0) in order to enhance fracture identification in imaging logging, and provide the basis for fracture identification in the interactive interpretation. Real data examples show that this approach is rather effective.

Key words: two-dimensional wavelet transform, imaging logging, fractured reservoir, conductivity

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Mathematical classification of magnetotelluric inversion methods. Han Bo¹, Hu Xiangyun¹, He Zhanxiang² and Cai Jianchao¹. *OGP*, 2012, 47(1): 177~187

During the past five decades, significant progress has been made in magnetotelluric (MT) method. Particularly the inversion techniques have been transformed from 1D into 2D, or even 3D. Nowadays there are numerous MT inversion methods, most of which belong to linearized, iterated approaches that make use of the gradient of the objective function, and almost all of these methods adopt strategies based on the same theory to handle the general ill-posedness of the inverse problem. This paper briefly introduces the basic idea of MT inversion, which is known as regularization theory. It then makes a mathematical classification of several main inversion methods according to the numerical optimization algorithms they employed so that the clear relationship among them can be acquired. In addition, their main merits and drawbacks are compared with each other. Finally, trends for MT inversion are considered.

Key words: magnetotelluric, inversion, regularization, numerical optimization

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