ABSTRACTS

Analysis of effects for second 3-D seismic acquisition in development area of oilfield. Sui Rong-liang, Duan Yong-qing and Yu Fu-wen. *OGP*, 2005, 40(6): 617~621

Because of limitation in equipments and technical level in that time, the earlier second 3-D seismic exploration (the first 3-D seismic exploration called in this paper) in Shengli Oilfield was characteristic of lower both S/N ratio and resolution in seismic data, which can't meet the needs for oilfield development so that it is imperative to carry out the second 3-D acquisition by using up-to-date exploration techniques and equipments in some prospective blocks. Through the practice of the second 3-D acquisition projects in Tianjia, Yujiazhuang and urban area of Dongying city, the paper considered that key of success in second 3-D acquisition lies in optimum design and scientific demonstration of concrete-surveyed-object-based geometry, meanwhile, it should pay more attention to investigate the surface structure and interference waves and make our best effort to choose optimum shooting and receiving parameters. It is shown by acquired second 3-D data in above mentioned three areas that both S/N ratio and resolution have greatly improved in comparison with the first 3-D data and achieved better geologic results.

Key words: second acquisition, geometry, studying acquisition methods

Sui Rong-liang, Key Laboratory of Education Ministry of Surveying Technology and Apparatus of Underground Information, China University of Geology, Beijing City, 100083, China

High-precision Random transform method and its application. Guo Quan-shi, Zhang Wei-hua, Huang Hua-chang and Li Pei. *OGP*, 2005, 40(6): 622~627

Random transform has been widely used in seismic exploration, for example, suppression of multiple, separation of P- and S-waves, seismic migration and inversion etc. The paper briefly introduced linear, hyperbolic and parabolic Random transform methods as well as sparse-constrained inversion and adaptive wave separation algorithm further developed on that basis; analyzed their advantages and disadvantages in the respects of scanning velocity, recognizing ability and wavefield restoration by synthetic data. It is shown a satisfactory effect by using these methods to suppress multiple in surface seismic exploration and tube wave in cross-hole seismic exploration.

Key words: Random transform, seismic data processing, wave separation, sparse-constrained inversion, multiple suppression, τ-p transform

Guo Shi-quan, Weigang 21, Institute of Geophysical Prospecting, SINOPEC, Nanjing City, Jiangsu Province, 210014, China

Using adaptive wavelet method to resolve issue of wave propagation. Wang Yi-bo, Tang Jian-hou and Yang Hui-zhu. *OGP*, 2005, 40(6): 628~631

The paper presented a numeric modeling method—— adaptive wavelet integration in time domain to resolve the issue of wave propagation. First, the dual variation was introduced and the wave equation in time derivatives of second order was reduced one-order equation by Hamilton transform, then, the wavelet analysis was used to digitize spatial variation of wave equation, the half-analytic solution in recursion form of original equation was obtained by combination with integration method in time domain. Using multi-scale property and vanishing moment property of wavelet analysis and in combination with threshold controlling, the calculating precision could be adaptively controlled; the stability of solution in time domain could be affectively guaranteed by using the half-analytic property of integration method in time domain. Comparison of numeric results with analytic solution showed the effectiveness of the method.

Key words: wavelet, wave propagation, integration in time domain, multi-scale analysis, numeric simulation, adaptive

Wang Yi-bo, Department of Engineering Mechanics, Tsinghua University, Beijing City, 100084, China

Fast KL filtering of seismic data by self-organizing neural networks approach . Liu Bao - tong and Zhu

Guang-ming. *OGP*, 2005, 40(6): 632～636

In seismic data processing, the KL filtering is often used for elimination of coherent and random noises in order to improve S/N ratio in seismic records. The concentrating algorithms such a-seigenvalue decomposition (EVD) and singular value decomposition (SVD) are generally adopted in ordinary KL transform, but the computational cost is higher when there is a large amount of seismic traces, which is difficult to use in practice. The paper first introduced the artificial neural network (ANN) to KL filtering of seismic signal that obtained projection vectors with orthogonal decomposition by self-organizing (without monitoring) studying weights connected in adaptive computational networks. The correlation of ordinary KL transform method with the method introduce in the paper by the test of theoretical records showed the consistence of the results by two methods, but fast in the method introduced in the paper in comparison with ordinary method when having more input traces of records, which greatly reduced computational cost in filtering processing that is rid of the large time-consuming shortage of KL filtering and more practical. The paper finally gave two computational cases of KL filtering of real seismic data.

Key words: KL transform, seismic data processing, neural networks, noise-rejection, coherent noise, S/N ratio

Liu Bao-tong, Apartment House No. 5, Room 301, Xi'an University of Science & Technology, Xi'an City, Shanxi Province, 710054, China

Limited entropy deconvolution. Wang Rui, Sun Cheng-yu and Shang Xin-min. *OGP*, 2005, 40(6): 637～641

Starting from traditional minimum entropy deconvolution, the paper studied the conception of entropy and its concrete meaning in seismic exploration and pointed out some problems existed in current-used minimum entropy deconvolution method. Faced with the disability that the normalized variance norm would suppress the weak reflections, the paper presented the method using the logarithm transform entropy norm to replace the normalized variation norm and changed the minimum entropy to limited entropy, which made entropy norm of seismic records close to given entropy norm but did not constantly reduce entropy. The method can effectively reduce suppression of weak reflections. The processed results of real data showed the correctness of the method, which can effectively improve the resolution of seismic data in a precondition of reducing suppression of weak reflections that better keeps the balance of total energy in seismic data. The method is further development of classic minimum entropy deconvolution.

Key words: seismic data processing, entropy, variance norm, deconvolution

Wang Rui, West Processing Room, GRI, Shengli Oilfield, Dongying City, Shandong Province, 257022, China

Study of blind deconvolution and application of method. Meng Xiao-hong, Wu He-zhen and Liu Guo-feng. *OGP*, 2005, 40(6): 642～645, 651

On the basis of mathematic framework of blind deconvolution presented by Mr. Guy Canadas et al[1] in view of the situations of non-minimum phase wavelet and non-white reflection sequence, the paper used the penalty term of reflection sequence characterized by sparse by using alternative relaxation solution and preconditioned conjugate gradient algorithm, which realized simultaneous evaluation of seismic wavelet and reflection coefficients. The results of theoretical models and real data processing showed that the method not only can better realize the simultaneous evaluation of seismic wavelet and reflection coefficients, but also has advantages of stable algorithm and fast convergence, which is effective tool of improving the resolution of seismic data that can effectively broaden the useful band of records, highlight the structural information and have good applied prospect in seismic data processing.

Key words: blind deconvolution, seismic wavelet, reflection sequence

Meng Xiao-hong, Key Laboratory of Education Ministry of Surveying Technology and Apparatus of Underground Information, China University of Geology, Beijing City, 100083, China

Inversion of fitted AVO attributes. Xiong Ding-yu, Qian Zhong-ping and Zhao Bo. *OGP*, 2005, 40(6): 646～651

Starting from the approximation of Zeoppritz

equation presented by Mr. Shuey, the paper obtained more accurate zero-offset reflectivity by fitting reflectivity changed with incident angles, which improved the signal-to-noise ratio of seismic data, while did not fundamentally change the relationship of reflected amplitudes changing with offsets in original CMP gathers of seismic data that can further inverse the accurate section of AVO attributes. The results of theoretical models and practical seismic data showed that in comparison with former-adopted AVO inversion the method not only can reflect the relationship of amplitudes changing with offsets at offsets, but also has no limitation of incident angles.

Key words: AVO, Zeoppritz equation, reflectivity, zero-offset, attributes section

Xiong Ding-yu, Box 11-1, Zhuozhou City, Hebei Province, 072751, China

Potential and limitation of identifying and describing ultra-thin reservoir by seismic technology. Du Shi-tong. *OGP*, 2005, 40(6): 652～662

In view of the fact that widely using multidisciplinary data (geologic, logging and seismic) to build up geologic models of reservoir currently in petroleum industry, it is necessary to define the property of developing seismic methods and techniques and its used scope so that can avoid the mistake in geologic decision. For that reason, it is necessary to carry out deep basic study for basic principles and applied conditions of some application techniques in developing seismic methods. The paper approached the following technical basic issues of developing seismic methods: ①discussed the relationship between heterogeneous degree of medium and detection-used seismic wavelength; ②discussed geologic-geophysical models taking as objects reservoir studied, which considered that geologic sequential body and seismic response of its cyclical structure would constitute a new cyclical seismic sequence model; ③discussed recognized ability of sequential body by seismic response, which considered that it should make the band of seismic signal expand to higher frequency skippingly according to frequency interval of sequential rank if want to improve the resolution of seismic data, otherwise, improvement of the resolution is meaningless; ④discussed the issue of selecting the frequency of seismic signal in reservoir object, considered that the selected receiving method is different when different size of reflection object is detected, lower frequency band should be used for thicker layer while higher band should be used for thinner layer; ⑤presented recognition basis for multi-scale objects and considered that geologic body in different size has different frequency response in seismic response and different imaging position in frequency axe and that the geologic body in different size could be recognized and described by using selective processing system; ⑥the paper also deeply discussed the studying steps of high-resolution developing seismic techniques and seismic interpretation ideas under sequential framework, approached the issue of multidisciplinary data set for different studying scale and pointed out the limitation of different methods and research direction.

Key words: seismic technology, reservoir recognition, reservoir description, heterogeneous degree of medium, geologic-geophysical model, frequency selection

Du Shi-tong, Institute of Earth Resource and Information, China University of Petroleum, Dongying City, Shandong Province, 257061, China

Identification of Cenozoic igneous rocks of Jiyang depression. Chen Hai-yun, Lin Chun-ming, Zhang Yun-yin, Hu Jia-shan and Hou Fang-ying. *OGP*, 2005, 40(6): 663～669

There is significant difference in petrophysical property between the igneous rock and sedimentary rock, the former is characteristics of large density, higher resistivity and magnetic susceptibility, higher velocity of seismic wave and strong attenuation of energy of seismic wave, therefore, the igneous rock can produce significant geophysical anomalous feature in sedimentary basin. The studied results showed that the Jiyang depression is Mesozoic and Cenozoic fault basin, the three epochs of Cenozoic igneous rock such as Early Paleogene, Late Paleogene and Neogene-Quaternary have been developed in the basin that have distinguished seismic reflection feature of sheetlike, dome, basin-shaped, mushroom and fuzzy and appear distinguished positive gravitational anomaly and magnetic anomaly. The anomaly manly concentrates in two central anomaly zones: Gaoqing in the south and Wudi in

the north where the two centers of volcanic activity in Jiyang depression are presented. It is considered after integrative analysis of seismic, drilling, gravitational and magnetic data that the igneous rocks in Jiyang depression generally distribute along the deep faults, the igneous lithology mainly is basic rock that could be divided into two belts: the south and north belts. The Cenozoic igneous rocks mainly distribute in the west part of Dongying sag and the east part of Huimin sag, magmatic activities tends to migrate from the north to the south.

Key words: Jiyang depression, igneous rock, seismic facies, gravitational/magnetic fields feature, distributing regularity

Chen Hai-yun, Department of Earth Science, Nanjing University, Nanjing City, Jiangsu Province, 210093, China

Study of seismic response for thick-layered volcanic rock. Mao Xiao-ping, He Da-wei, Xin Guang-zhu and Leng Xue. *OGP*, 2005, 40(6): 670～676

In M area of Liaohe depression, the beggest difference of thickness in volcanic rocks can reach to 570m, in order to accurately know the wave characters of thick volcanic rocks, the paper used staggering grid finite-difference algorithm of wave equation to forward simulate the seismic response of layered volcanic rocks in M area of Liaohe depression. The analyses showed that because the volcanic rocks are characteristics of high velocity and high density, the thick volcanic rock has great influence on the precision of structural interpretation, its influence on underneath formations is not only the scattering (or shield function), but also appears the phenomenon: "depression becoming shallower and uplift becoming sag". The exact contents are as follows: ①in comparison with the area having thin volcanic rocks (or without volcanic rock), in the area having thick volcanic rocks, the "eaten up" travel-time can reach 177ms because of high velocity in volcanic rock, among which it can lead the uplift amplitude of underneath formations to become greater and sag amplitude——smaller in seismic imaging configuration nearby the thick volcanic rocks; ②in the position without volcanic rock or of thin volcanic rock, it leads the uplift amplitude of underneath formations to become smaller in seismic imaging configuration; ③if without considering the distribution of volcanic rocks in space, the volcanic rocks 500～600m thick can cause 200～300m interpretation errors in depth for underneath formations when the time—depth conversion is implemented by using uniform time—depth template.

Key words: wave equation, forward modeling, volcanic rock, shield function, ray tracing, Zoeppritz equation

Mao Xiao-ping, Department of Energy Resource, China University of Geology, Xueyan Road, Beijing City, 100083, China

3-D visualization interpretation technique of channels. Wang Juan, Chen Yu-lin and Guo Bao-xi. *OGP*, 2005, 40(6): 677～681

Faced with many issues in appreciation and development of shallow fluvial facies sandstone reservoir in the east parts of China, the paper presented 3-D integrative visualization interpretation technique adaptable to shallow fluvial facies thin-and-interbedded sandstone, which mainly included the following contents: facies-controlled isochronal minor formation correlation guided by high-resolution sequence stratigraphy, fine labeling of reservoir, fine description of structure, interactive analysis of three facies (logging facies, seismic facies and sedimentary facies), optimum selection of seismic attributes relative to interbedded sand bodies, automatically tracing amplitude attribute and 3-D visualization interpretation of channel, the forward simulation of interpreted formation model and prediction of reservoir by geostatistics. The effectiveness of the technique has been proved by using it for surrounding area of Gangxi oilfield in Dagang Oilfield and achieving significant success.

Key words: Meandering river, 3-D visualization, forward simulation, multi-attributes analysis, Gangxi oilfield

Wang Juan, Department of Reservoir Appreciation Project, Dagang Oilfield Sub-Cooperation, Tianjing City, 300280, China

Seismic prediction of fracture in igneous rock in Shang-741 well zone. He Rui-wu, Huang Han-dong, Li Qun, Wei Shi-ping and Jiang Xiao-jian. *OGP*, 2005, 40(6): 682～687

Applying seismic data to predict the fracture is

not only relative to real effects of oil-gas development, but also a front subject of seismic exploration. Adopting the idea companing the prediction of lithology with the prediction of fracture, the paper first used logging-constrained seismic inversion to clarify the distribution of igneous rock in Shang-741 well zone, then, carried out the non-isochronal fracture identification along the top and bottom interfaces of igneous rock by using 3-D multi-scale edge detection technique, finally conducted the prediction of fractures by combining with the structural interpretation and drilling and logging data and presented the areas favorable for oil-gas distribution. The predicted results showed that the method has advantages of high-predicted precision and better fit with practice, which could guide arrangement of well site in this area and have higher practical value.

Key words: distribution of igneous rock, fracture prediction, logging-constrained inversion, multi-scale edge detection, oil-gas potential prediction

He Rui-wu, Linpan Oil Production Factory, Shengli Oilfield, Lingyi Country, Shandong Province, 251507, China

Fine interpretation of complex fault-block structure. Ma Li-juan and Jin Zhi-jun. *OGP*, 2005, 40(6): 688～692

Faced with the issue traditionally taking 3-D seismic data as infill 2-D seismic data to conduct structural interpretation, the paper presented the methods and flow for interpretation of complex fault-block structure, established using cross-correlation envelope of synthetic seismograph with uphole seismic trace to solve the fine labeling method of time-shift and phase sweeping, implemented imaging of faults with different scale by using frequency-divided processing of seismic data and selection of dominant frequency, utilized color inversion to highlight faults and adopted multi-data volume to interactive interpretation. The method achieved good results when using it in interpretation of GB buried hill.

Key words: well-controlled processing, frequency-divided imaging, color inversion, frequency-divided coherence, multi-data volume interactive interpretation

Ma Li-juan, Research Institute of Petroleum Exploration and Development, SINOPEC, Xueyuan Road, Beijing City, 100083, China

Geologic meaning and key techniques of 3-D large-area multiple-block-jointed prestack time migration processing in fault basin. Zhou Hai-min, Zhang Wei, Xie Zhan-an, Cao Meng-qi and Liu Zhan-zu. *OGP*, 2005, 40(6): 693～699

3-D seismic exploration has been basically finished in oil/gas-bearing structural belts of China eastern continental fault basins. In order to renew knowledge and appreciation of these fault basins according to current sequence-stratigraphic theory, the 3-D large-area prestack time migration processing in fault basin is a necessary choice. Taking the Nanpu sag as an example, the paper highlights the analysis of the feasibility of multiple-block-jointed prestack time migration processing and its key techniques. It is shown by achieved processing results in Nanpu sag that carrying out the 3-D large-area multiple-block-jointed prestack time migration processing in continental fault basin has important meaning for deepening geologic knowledge, digging the potential in depleted fields, achieving new breakthrough in new exploration areas and fulfillment of sustainable development of oilfield.

Key words: fault basin, large area, prestack time migration, multiple-block-joint, effect

Zhou Hai-min, Jidong Oilfield, Xinghuaxi Road, Tangshan City, Hebei Province, 063000, China

Dip-moveout-correction (DMO) for VSP corridor stack. Meng En, Mu Feng-ming, Zhao Yan-Qing and Xu Gang. *OGP*, 2005, 40(6): 700～702

Using ordinary VSP corridor stack section to label the horizons often causes errors when dip formation exists, and these errors increases with dip of formation increasing and decrease with the distance between the downhole geophone and interface of formations decreasing. Obviously, this kind of error can not be negligible. Starting from VSP surveying geometry and spreading path of seismic wave, the paper pointed out the source of the errors, got the relationship between the error and dip size, geophone position and corridor and deduced DMO formula for corridor stack. It was shown by theoretical test and real data processing that the method is effectiveness.

Key words: VSP corridor stack, formation dip, moveout correction, horizon labeling
Meng En, Institute of Geoscience, China Marin University, Qingdao City, Shandong Province, 266071, China

Simulation of far-field wavelet based on near-field measuring gun-array. Chen Hao-lin, Quan Hai-yan, Liu Jun, Li Xiao-dong and Xu Kai-jing. *OGP*, 2005, 40(6): 703～707

Far-field wavelet is important parameter weighing up the goodness and badness of gun-array and of seismic data processing, therefore, the tool that far-field wavelet of gun-array can be real-time obtained along with gun shooting has been gradually paid attention by geophysical industry[1]. But the demand of recording far-field wavelet can't be met when water depth is only tens meters in ultra-shallow sea area. For that reason, we have been carried experiments in Bohai bay area and recorded near-field wavelet of gun-array on the sea, then computed far-field wavelet of gun-array in the computer. The results fit well with wavelet simulated by PGS-Nucleus software system, which proved feasibility of the method and opened up possibilities for real-time obtaining far-field wavelet of gun-array.
Key words: gun-array, near-field wavelet, far-field wavelet, wavelet simulation, real-time recording
Chen Hao-lin, Department of Marine Exploration, BGP, Tianjing City, 300280, China

Testing anisotropy of ultrasonic velocity and attenuation in coal samples. Zhao Qun and Hao Shouling. *OGP*, 2005, 40(6): 708～710

Taking acquired rock samples from real coal strata, processing them into two kinds of models (22 octahedrons and 2 icosahedrons) and tests in ultrasonic P wave and S wave have been carried out for these two kinds of models by pulse transmission technique. The analysis of tested results showed the existence of orientation-alighted fractures in coal samples produce distinguished anisotropy of velocity, S-wave splitting and anisotropy of attenuation, meanwhile, more obvious variation of dynamic feature of P-wave than kinematic feature is discovered and variation in attenuation of P-wave with fracture azimuths is more distinct than S-wave, which provided reliable experimental basis for using the variation of P-wave attributes to detect and predict the fractures.
Key words: coal strata, fracture, anisotropy, azimuth, attenuation, ultrasonic test
Zhao Qun, Weigang 21, Institute of Geophysical Prospecting, SINOPEC, Nanjing City, Jiangsu Province, 210014, China

Application of AVO attributes crossplot interpretation technique to predict carbonate reservoir. He Cheng, Cai You-hong, Li Han and Yang Fan. *OGP*, 2005, 40(6): 711～715

AVO attributes crossplot interpretation technique is to detect AVO attributes by forward simulation of models and then build up corresponding relationship among lithologic parameters of reservoir, fluid property and AVO attributes according to distribution relation of models to real seismic data on AVO attributes crossplot. Taking the analysis of forward simulation of models as a basis and AVO attributes in seismic data as an extrapolating control condition, the method closely combines the seismic, geologic and logging information together so that can reach the goal of identifying reservoir. Taking the Feixianguan oolitic beach reservoir in LJZ area of the east part of Sichuan Province as an example and through the analysis of drilling and logging data and forward simulation of models, the paper determined the response mode of seismic attributes of oolitic beach reservoir and its distribution feature on crossplot, identified the lithology of reservoir and the fluid property and further determined the gas－water interface of reservoir.
Key words: AVO, attributes, crossplot, carbonate, dolostone
He Cheng, Geophysical Research Center, Department of Geologic Survey, Sichuan Petroleum Administration, Huayang Town, Chengdu City, Sichuan Province, 610231, China

Seismic prediction of physical property for turbidite sand body reservoir in Niuzhuang sub-sag. Zhang Jian-ning. *OGP*, 2005, 40(6): 716～720

Statistic and regressive analyses have been carried out for petrophysical character and seismic attributes of known turbidite sand body in Es^3 of Niuzhuang sub-sag. The studied results showed: ①

the velocities of different lithology in Es^3 of Niuzhuang sub-sag are different, the velocity of carbonic sandstone is the highest, sandstone is second and mudstone is the lowest; ②the physical property of reservoir is bad for turbidite sand body characterized by very strong and very weak reflection amplitude, so that the physical property of reservoir could be identified qualitatively by reflection amplitude; ③ the corresponding unitary relationship between seismic attributes and reservoir parameters is difficult to be defined in total area, but external factors affected variation of reflection amplitude are basically same for same sand body, so that the regressive experimental formula can be used for quantitative calculation of physical property; ④it can't unilaterally and blindly seek the general adaptability of predicting methods and calculating models when using seismic attributes to predict the physical property of reservoir.

Key words: turbidite sand body, lithologic velocity, reflection amplitude, physical property of reservoir

Zhang Jian-ning, Integrative Room, GRI, Niuzhuang Town, Dongying City, Shandong Province, 257100, China

Using normal distribution to identify oil layer and water layer in Qingxi complex reservoir. Sun Zhi-wen, Ma Cai-qin, Wu Hui, Zheng Ying-zhao and Liu Zi-ping. *OGP*, 2005, 40(6): 721～723

It has been formed a set of effective reservoir-identified techniques to carry out reservoir appreciation by using logging data now, but it still has some difficulty to identify the fluid nature of fractured reservoir in complex lithology by using the set of techniques, for example, it is difficult to identify the reflection of electric property for fluid in stratum because of the influence of lithology and fracture. Especially, the response of logging data is complex in the reservoir of Qingxi oilfield, and it can't achieve good results by using logging data to identify the oil layer and water layer. For that reason, the paper used normal distribution to correctly judge the fluid property in corresponding reservoirs of Qingxi oilfield, better identified oil layer and water layer, which achieved better applied results in oilfield application.

Key words: Qingxi oilfield, fluid property, normal distribution, apparent resistivity of formation water, oil layer and water layer

Sun Zhi-wen, Department of Exploration, Yumen Oilfield Sub-Cooperation, Yumen City, Gansu Province, 735200, China

Progress in studying seismic recognition and prediction technology in fracture-developed zone. Zhang Xin and Zheng Xiao-dong. *OGP*, 2005, 40(6): 724～730

Fractured reservoir widely distributes in global area and exploration of fractured reservoir has important position in oil/gas exploration. Because of complex genesis of fracture and developed degree being controlled by multiple factors, although there is fracture information in seismic data, the seismic response caused by fracture factor is far more less than that by other geologic factors, so that it is difficult to use seismic data to identify the fracture. Nevertheless, since the seismic data have advantage of lateral continuity, the people still considered that the seismic method has irreplaceable role in fracture description and prediction. The paper briefly analyzed the difficulties and countermeasures when using seismic data to study fracture and summarized major techniques and methods using seismic data to study fracture in global area, which gives a reference to further develop the study at home.

Key words: fracture, seismic data, forward modeling, inversion, velocity, attributes, fractal

Zhang Xin, Research Institute of Petroleum Exploration and Development, No. 20, Xueyuan Road, Beijing City, 100083, China