ABSTRACTS

An economic and efficient method for 3D, 3C geometry design. Huo Quan-ming, Cheng Zeng-qing, Peng Su-ping and Hu Chao-yuan. *OGP*, 2004, 39 (5): 501~504

Starting from studying propagation rule of seismic converted wave in underground medium, the paper presented a practical method for 3D, 3C seismic exploration acquisition design. The basic ideals are that in 3D, 3C survey the receiving windows between P-wave and PS converted wave are inconsistence but both are optimum receiving windows in intermediate offsets, some parts of the short and large offsets are needed to be preserved in order to protect the shallow layers and be of benefit for AVO analysis. Therefore, the useful windows of designed geometry made the acquisition of P-wave and PS converted wave reach to 85%, that is the double 85% criterion of 3D, 3C acquisition design, resulted in using one spread patch for acquisition of P-wave and PS converted wave and ensuring that the period repeat of folds of PS converted wave is basically not appeared. The study has been successfully used in production objects.

Key words: 3D 3C, geometry, double 85% criterion, economy, reasonableness

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Discussing again about possibility using Rayleigh wave for investigation of near-surface structure. Wang Zhen-guo and Zhou Xi-xiang. *OGP*, 2004, 39 (5): 505~508, 538

Rayleigh wave is a secondary wave characterized by low frequency and strong energy, propagating mainly along the interface of medium and rapid attenuation of energy with increase in interface distance. Like the reflection and refraction, the Rayleigh wave also contains geologic information of subsurface medium. Based on basic methods investigating near-surface structure by Raileigh wave, the paper computes near-surface structure using real data of multi-layers and dip-layers, which proved again that it is feasibility using Rayleigh wave on seismic single shot records for investigation of near-surface structure.

Key words: investigation of near-surface structure, Rayleigh wave, dispersion curve, velocity, low-velocity zone

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Length fractal dimension method for picking seismic first break. Cao Mao-sen, Ren Qing-wen, Wang Lin-mei and Luo Yong. *OGP*, 2004, 39 (5): 509~514

The paper theoretically analyzed Hausdorff fractal dimension and Divider fractal dimension algorithms and presented uniform simplified algorithm for Hausdorff fractal dimension and Divider fractal dimension algorithms—Length fractal dimension algorithm. The realizations of the method are follows: ①defining a window width on a seismic trace, computing fractal dimension of sampled seismic data sequence within the window and labeling the value at the sample of right edge of working window; ②moving the window forward along the seismic trace with step-length of one sample interval and computing fractal dimension at each window, then resulted in one variance track of fractal dimension; ③the local track appeals a clear "V" form along with first break gradually enters the window, zooming regionally the local apex in left branch of "V" track, the first rapidly-dropping point is symbol of first break entering window, which corresponds the arrival of first break. The theoretical analysis and practical test showed that the Length fractal dimension method characterized by small computational efforts, without setting measure (fold) scale, removing inconsistent coordinate scale, sensitive to first break of seismic wave, small influence of window width on stability and precision of computed results and strong anti-noise ability, meanwhile, there is no limit to wave mode of first break when computing fractal dimension.

Key words: Hausdorff fractal dimension, Divider fractal dimension, improved algorithm, Length

fractal dimension,seismic first break

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Stable Homotopy path tracking algorithm and application. Zhang Li-qin, Wang Jia-ying, Yan De-tian and Xu Jian. *OGP*,2004,39(5):515~518

Most of geophysical inversion are non-linear problems, the homotopy method based on path tracking is effective method for solving this kind of problems. The path skip is often appealed in common homotopy, which can't effectively solve the accurate path tracking issue. The paper presented tomotopy path tracking algorithm that can stably solve the non-linear equations set. The method uses the local curvature of homotopy zero curve to control prediced step-length, uses improved Newton iteration in reference [19] to end judgment, which further improved the stability and reliability, realized accurate path tracking and avoided the path skip in a process of tracking. The numerical calculation showed that the method has good stability and wide practicality, without strict limitation in selection of first value, the solution can be fast convergence, even though random selected first value deviates far from the solution of objective function, so it is large-scope convergent method that is suitable for solving geophysical non-linear inversion.

Key words: homotopy, path tracking, inversion problem

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Imaging velocity model-building method based on common focus point technique. Xin Ke-feng, Wang Hua-zhong and Ma Zai-tian. *OGP*,2004,39(5):519~525

Imaging velocity model-building is key technique of depth imaging in complex structures, which includes two aspects: imaging velocity analysis method and velocity model-building used for integrative analysis. The paper analyzed current major imaging velocity analysis methods and pointed out that study of imaging velocity analysis should develop toward the direction of a system. The system and practicality of imaging velocity model-building based on common focus point technique have been studied in the paper,the paper also presented two methods for realizing velocity analysis based on common-focus-point gathers according to the principle of equal travel-time and the thought of renewing operator:①interactive velocity analysis method based on spectrum analysis,. which is mainly used to create primary imaging velocity model;② tomographic inversion, which is used for iteration and renewing of imaging velocity model. SeisVel velocity model-building software provided the integrated environment for these two methods. The synthetic data test showed that the thought of imaging velocity model-building based on common focus point technique presented in the paper is effective, the developed method and software basically can meet practical needs.

Key words: common focus point, velocity model-building,tomography,prestack depth migration

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Static corrections of offshore high-resolution seismic survey. Qian Li-ping, Liu Bao-hua and Wang Kui-xiang. *OGP*,2004,39(5):526~531

The quality of static corrections is one of key factors, which directly affects the stack results. Land seismic exploration pays more attention to static corrections, while offshore seismic survey does not. Actually,the relief of cable caused by sea resulted in time-shift in seismic records is not be neglected. Based on the criterion of maximum stack energy and correlation technique, the paper presented a set of static corrections aimed at offshore seismic data. The theoretical model test showed that the demand of offshore high-resolution seismic exploration can't be met when height of wave is greater than 0. 3m. Therefore,the paper presented three static corrections methods that remove the influence of sea. The practice showed that the method is effective method for improving the resolution of offshore seismic exploration.

Key words: seismic exploration, high-resolution, criterion of maximum stack energy, correlation technique,math model,static corrections

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Method of PS wave residual static corrections and application.

Zhao Xiu-lian, Xu Shi-yong and Ma Zai-tian. *OGP*, 2004, 39(5): 532~538

The PS converted wave has different feature from P-wave, therefore, the seismic data processing of PS-wave is different too, among which the method of residual static corrections is one of them. Cary et al considered that the residual statics are approximate to the statics at the receiver points in a scenario of surface-consistent hypothesis, less complex underground structures and more statics at the receiver points. Therefore, it is possible to use the maximum correlation value between model trace and Common-Receiver-Point (CRP) gathers for realizing maximum stack power and further to pick the statics of CRP relative to maximum values. In order to verify the practicality of the algorithm, the paper carried out not only the test of theoretical model, but also the processing of practical PS converted wave data, which showed that in comparison with ordinary methods the Cary's method of residual static corrections is characteristics of evident effects and stable operation.

Key words: converted wave, residual static corrections, CRP gather, maximum stack power

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Using waveform to create seismic facies.

Deng Chuan-wei. *OGP*, 2004, 39(5): 539~542

In seismic attributes, the general variation of waveform and its distributed rule is most important seismic parameter, which is often neglected by the people. Using waveform to create seismic facies is to use neural network technique to quantitatively describe the general variation of seismic signal, more simply, that is to arrange the waveform under categories. The paper briefly introduced the basic principle of the method, its general flow, key parameters test effects and key technical links controlling quality of process. The practice showed that the seismic waveform includes a lot of geologic information, picking and identifying the information are important work in a process of seismic data interpretation. This method is of benefit to reservoir prediction, reservoir description and improving drilling successful rate.

Key words: seismic attributes, general variation of waveform, seismic facies map, neural network, correlation curve

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Study of seismic data processing and appreciation based on prestack relative preservation of amplitude, frequency, phase and waveform.

Ling Yun Research Group. *OGP*, 2004, 39(5): 543~552

Theoretical model computation and real cases analyses showed that the thin-layer information that is less than 1/4 seismic wavelength can be acquired by analysis of seismic attributes only if special amplitude, frequency, phase and waveform can be relatively preserved. It is thus clear that the high-resolution seismic data processing based on prestack relative preservation of amplitude, frequency, phase and waveform is key of identification and appreciation of thin-layer. From the angles of the seismic processing and geologic interpretation, the paper presented separately the methods whether the corresponding appreciation can meet above-mentioned relative preservation. As concerns the former, ①using test of 3-D shooting amplitude with dominant frequencies, test of 3-D shooting wavelet and statistic spectrum analysis based on monitor shot to determine whether the used methods aimed at improving resolution can meet the needs of relative preservation; ②whether the high-precision velocity fields can be acquired; ③whether the coincidence with the applied conditions of imaging theory in propagating medium is considered. As concerns the latter, a stable reference mark bed that can be continuously traced in whole region exists around the target (to meet the condition within a sedimentary cycle) in prospecting zone is needed.

Key words: prestack relative preservation of amplitude, improving resolution, appreciation of seismic information, appreciation of geologic information, picking isochrone seismic attributes

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Seismic attributes and their affected factors in reservoir prediction. Hou Bo-gang, Yang Chi-yin, Wu Zhan-guo and Wu Bo-fu. *OGP*, **2004, 39 (5):553~558,574**

Seismic attributes plays a bridge role between the exploration seismology and developing seismology. The paper considered that renewing the knowledge of seismic attributes classification and geologic meaning that the seismic attributes are extracted from a single time-window along an event and the principle of optimized attributes are of importance to apply the attributes to real geologic issues. The discussion in the paper also centered on the influence of velocity, signal-to-noise ratio and frequency bandwidth on application of attributes to the precision of reservoir and oil-bearing prediction.

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Mesozoic sandstone reservoir prediction technique and application in XF area. Wang Da-xing, Gao Jing-huai, Li You-ming, Xia Zheng-yuan and Wang Bao-jiang. *OGP*, **2004, 39(5):559~564**

In the seismic data interpretation in XF area of Erdos basin, the following techniques are used: high precision seismic sequence processing interpretation and Triassic top palaeogeomorphic interpretation technique; the following techniques are used for lateral reservoir prediction: automatic classification and qualitative identification of seismic facies, band-limited seismic inversion, simulated annealing inversion and energy body attenuation analysis technique. The key using the method for optimum reservoir prediction is to well-use the energy body attenuation technique, Bouguer power spectrum analysis and technique of instantaneous frequency analysis by wavelet transform and to reveal the structure and lithologic variation of reservoir and relation between the reservoir and oil-gas. Currently, there are 6 drilling holes such as the X1 well etc. that have been finished, using these boreholes data to examine the prediction of Chang 8_1 segment reservoir, the results showed that there are 4 wells where the thickness of sandstone is coincident with the predicted result, the successful predicted rate is about 66.7%, which provided the basis of defining the oil-bearing area of 3-level oil reserve in the region.

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Application of BP artificial neural network to geologic appreciation of traps in Jiyang depression. Xu Gang, Zhang Jian-ning and Tan Ming-you. *OGP*, **2004, 39(5):565~569**

The method using artificial neural network for geologic appreciation of traps can fully consider the different prospecting degree, geologic scenario and user demand and can make the geologic appreciation of traps reach the unity between objective reflection and subjective appreciation if according to the opinions of specialists and characters of concrete parameters and to flexibly set the size of "weight". The paper used artificial neural network to build up typical sample traps that are divided into 4 categories and 20 different types, defined the weight of different geologic factors in different types of typical sample traps after statistic analysis and appreciated geologically 50 traps. There are 18 traps that the predicted results are coincidence to the real-drilled results among 20 drilled traps and successful rate is about 90%; there are 6 traps that have good appreciation among 10 traps without drilling, which have higher exploration value.

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3-D interval velocity model and imaging effect on Huoyan Mountains. Yang Biao and Li Hong. *OGP*, **2004, 39(5):570~574**

The key of seismic data processing mainly lies in static corrections and imaging and both of them are relative to velocity model in complex near-sur-

face and underground geologic structural conditions. The paper analyzed the influence of surface model, near-surface model and interval velocity model on static corrections and imaging, studied mutual relation among static corrections and imaging as well as interval velocity model in the procedure of data processing, presented the realized methods of prestack depth migration when the velocity model included surface elevation and near-surface model and reasonably solved the combined influence of surface elevation, surface weathered layer and near-surface layers on static corrections and seismic imaging, which achieved good applied results.

Key words: Tu-Ha Oilfield, prestack depth migration, surface model, static corrections

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On surveying depth by transient electromagnetic sounding method. Xue Guo-qiang. *OGP*, 2004, 39 (5): 575~578

The temporal procedure of equivalent circuit of transient electromagnetic transmitter loop is analyzed in the paper, the theoretical expressions of amplitude of loop self-induction signal is deduced, which considered that the attenuation of loop self-induction signal is not only relative to time, but also to the material of equivalent loops; the amplitude and time-decay scope of self-induction signals with different loop sizes are computed, which obtained the conclusion that there is the minimum depth when using transient electromagnetic method for sounding survey. The transient electromagnetic method has a maximum depth because of continuous attenuation by transmission of electromagnetic signal in underground. The paper gave the method and evaluation results for evaluated min and max sounding depths by using transient electromagnetic sounding in the conditions of common equipments (different coil sizes and different medium resistivity) and typical geoelectric scenario. The resulted transient electromagnetic sounding depths played a guide role in field production.

Key words: transient electromagnetic method, minimum sounding depth, maximum sounding depth, loop self-induction, signal decay

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Data processing joining several 3-D seismic surveying blocks together in Shengli Oilfield. Liu Cheng-zhai. *OGP*, 2004, 39(5): 579~585

Total 189 blocks of 3-D seismic data acquisition have been finished in Shengli Oilfield. In order to integrative studying regional geologic structures and role of oil accumulation, it is necessary to implement the data processing joining several 3-D seismic surveying blocks together. The paper summed up a set of basic flow for data processing joining several 3-D seismic surveying blocks together suitable for complex areas after analyzing this real data processing. During this processing, we adopted relative processing methods and tools aimed at inconsistence between blocks, which made joined 3-D data blocks have good consistence of phase and porosity and natural and reasonable frequency and energy (or amplitude), it also made the geologic feature such as overlap, unconformability, fracture and pinchout have good reflection on the sections. It is seen from total effects that the geologic feature in whole region is abundant, having complete beds and higher signal-to-noise ratio and continuity, which laid a good foundation for improving interpretation precision of seismic data and successful drilling rate.

Key words: Shengli Oilfield, 3-D seismic, processing joining 3-D data blocks together

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Application of multiple seismic attributes parameters to lateral reservoir prediction. Sun Wan-jun. *OGP*, 2004, 39(5): 586~588

The multiple seismic attributes are widely used for lateral reservoir prediction now, mainly include offset-related peak frequency and phase, AVO information, P-and S-wave velocities and wave impedance information. The paper mainly used AVO and FVO attributes, combining with drilling data, to detect the oil-water boundary, spa-

tial distribution and thickness of reservoir. In order to improving the accuracy of prediction, the paper especially emphasized on well-doing "3H" seismic data processing, detection of AVO and FVO in prestack stage, then jointly-used AVO and FVO information to implement practical prediction. The method was used for detection of A oilfield and gained success, better solved the problem of undefined oil-water boundary many years ago in the area.

Key words: multiple parameters, reservoir prediction, AVO, FVO

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Study of pseudo-linear approximate method for stable current field. Chen Li-hong and Sun Jian-guo. *OGP*, 2004, 39(5): 589~593

Pseudo-linear approximate method is approximate method presented by Mr. Zhdanov during the process of study on forward and inversion problems of electromagnetic scattering. Because the similarity between integration equation of stable current field and integration equation of electromagnetic scattering, the pseudo-linear approximate method can be used to study the issue of stable current field. The key that determines the method being effectiveness is whether the simple and feasible method can be used to calculate the parameter λ. The paper mainly discussed the variation rule of parameter λ in some common simple geoelectric models. The studied results showed that the parameter λ can be considered as slowly changed function of position in common scenario of direct current (DC) electrical prospecting and can be acquired by simpler method. This study laid a foundation for using pseudo-linear approximate method to realize the rapid inversion of stable current field.

Key words: stable current field, pseudo-linear approximate method, DC electric prospecting, integration equation

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Comparison among several inversion algorithms of 1D MT. Feng Si-chen, Wang Xu-ben and Ruan Shuai. *OGP*, 2004, 39(5): 594~599

MT inversion algorithms are mainly divided into two categories: linear and non-linear algorithms, among which the Marquit method, genetic algorithm and method of simulated annealing are representative algorithms. The paper compared the inversion procedures, results and theories among these three methods and pointed out each advantages and limitations and corresponding conditions needed to pay attention when these methods are used. The study showed that the Marquit method has poor ability in global optimization of objective function, only has ability in local optimization, but its operation speed is fast; simulated annealing and genetic algorithm have strong ability in global optimization of objective function but slow speed of algorithm. The Marquit method is chosen as inversion method when knowing underground geoelectric parameters in some degree in advance and being able to choose more reasonable preliminary solution, otherwise, the other non-linear inversion algorithms that have strong ability in global optimization are chosen.

Key words: linear, non-linear, global optimization, local minimum point, random searching

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Reduction-to-the-pole at low latitude by direct damper filtering. Yao Chang-li, Huang Wei-ning, Zhang Yu-wen and Zhang Xi-lin. *OGP*, 2004, 39(5): 600~606

At low and intermediate latitude, reduction-to-the-pole technique is basic work in interpretation of magnetic survey data. In order to overcome the unstableness of reduction-to-the-pole at low and intermediate latitude, there are varieties of methods of reduction-to-the-pole. The paper presented the reduction-to-the-pole by damper method. The method is characterized by evident physical meaning, simple and straightforward operation and a fewer control parameters. The method showed after calculating tests by single model and combined model that the method is irrelative to design complex reference model, there is no complex inversion procedure either in the method; the method is facile not only in realization, but also in

processing of massive data volume, which can reach the best level up-to-now.

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Sequence-sedimentary interpretation in fault lake basin and prospecting of concealed reservoir. Li Jian-xiong, Li Ming-jie, Zhao Xiu-qi and Liu Chun-fang. *OGP*, 2004, 39(5): 607~613

Fault lake basin is the object of oil-gas exploration having typical meaning in continental sedimentation basin of east China, which is characterized by rapid changes of facies, difficulty in correlation of sequences and complex supply of source rock. Therefore, During the procedure of oil-gas exploration in that regions, it is necessary to integrative use of geologic and geophysical techniques, that is in a background conditions of evident structural deposition, it is mainly on the basis of sequence-sedimentary analysis and determination of depositional sequence framework in the target zone, then, defining the concrete prospecting objects by combining with application of seismic techniques and through the analysis of sedimentary micro-facies and attributes, forward and inversion works and full 3D visualization, which can result in getting twice the result with half the effort.

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Geometric feature of No. 2 fault in Yitong graben and its relation to oil-gas. Li Hong-ge, Li Ben-cai, Han Long and Ding Ye. *OGP*, 2004, 39(5): 614~617

The No. 2 fault of Yitong graben is an important fault of Yitong graben, which is divided into Luxian fault depression and Chaluhe fault depression, both sides of fault developed two important hydrocarbon-bearing structural zones: Liangjia and Wuxing hydrocarbon-bearing structural zones. After fine interpretation of high-quality of 3-D seismic data, the paper studied geometric feature of No. 2 fault, analyzed its specially variated characters, dynamic evolution and relation to hydrocarbon accumulation and considered that the No. 2 fault not only laterally cuts Yitong graben, but also plays the role of controlling basin: it connected with east-edged fault of Chaluhe fault depression eastward and its evolution experienced early tensional and torsional actions and latter press and torsional actions, which has evidently controlling role of development of structural zones on both sides, the paper also considered that the fault is an important fault of oil-source, which has controlling role of hydrocarbon accumulation.

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Several notes about "time difference of time-lapse in layered medium". Yun Mei-hou. *OGP*, 2004, 39(5): 624~627

The method of approximate velocity inversion in the paper "time difference of time-lapse in layered medium" (simplified as "time difference" in the follows) published by 《Oil Geophysical Prospecting》 is worth discussing. The paper gave accurate formula of direct velocity inversion. The author considered by theoretical study that the raypath corresponding to same shot point and receiver point is unique in uniform horizontal layered medium. The model test showed that the calculated result of time difference based on shot point and receiver point is generally larger, but the rule of variation reflected in time difference is coincident to qualitatively analyzed result in the paper.

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