ABSTRACTS

Analysis on influence of bin size on resolution of seismic imaging: study of acquisition parameters based on seismic physical modeling. Di Bang rang, Xiong Jin liang, Yue Ying, Wei Jian xing, Xue Guang jian and Gu Pei cheng. *OGP*, 2006, 41(4): 363 ~ 368

Study of relationship between bin size and resolution of seismic imaging is an important task in 3-D high-resolution data acquisition. Among which reducing bin size not only improving lateral spatial resolution, but also improving vertical time resolution is controversial issue produced during the task studied and practical tests. In combination with geologic properties in eastern China, the paper designed two abstract geologic models by using 3-D seismic physical modeling technique to study the influence of CMP bin size on the resolution of seismic imaging, and obtain some useful conclusions: for flat area, the bin size does not affect the vertical resolution of seismic imaging; for dip beds, it should do more experiments to study; reducing bin size can improve lateral resolution, but there is a limit to the improvement; it can optimize the bins in different sizes under different preconditions.

Key words: CMP bin, seismic physical modeling, seismic imaging, time resolution, spatial resolution

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Vector prestack depth migration of multi-component wavefield. He Bing shou and Zhang Hui xing. *OGP*, 2006, 41(4): 369 ~ 374

The paper studied a vector prestack depth migration method—prestack inverse-time depth migration for two components records in 2D isotropic medium. Firstly, staring from the elastic wave equation, high-order finite-difference format of elastic wave inverse time continuation in isotropic medium was deduced in staggering grid space; then, proceeding from the eikonal equation, the seismic travel time at each underground point was computed by inverse time finite-difference format. In order to ensure the causality of seismic propagation and adaptability to complicated model, expanding wave front method was used to track wave front and search global minimum, taking above mentioned computational results as imaging condition of elastic wave inverse time migration. The prestack inverse time depth migration of 2D multi-component data can be realised. The tests of model and real single-shot records showed the prestack inverse-time depth migration considered the vector feature of seismic wave, which is an effective vector wavefield processing technique.

Key words: multi-wave exploration, vector wavefield, data processing, inverse time migration, imaging condition

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Model-building method of static corrections in seismic data pieces jointed processing. Wang Xi wen. *OGP*, 2006, 41(4): 375 ~ 382

In view of surface seismic conditions and requirement of geologic task in Mahu slope area of Jungar basin, the paper presented model-building method of static corrections in seismic data pieces-jointed processing. Taking field statics in whole work area as controlling grid, the method mainly uses the refraction statics for integrative static corrections model-building, so that solved the issue to put three blocks of 3-D seismic data together side by side (without mis-tie and phase difference) and clarified low-amplitude structures, stratigraphic unconformity relationship and fault location in the area, at the same time, ensuring the structural reality in juncture region of three blocks of 3-D seismic data. Meanwhile, the Triassic Baikouquan Formation 3-rd sand Member litho-stratigraphic traps of northern Ma 005 well in juncture region of three blocks of 3-D seismic work areas were discovered, displaying good oil/gas exploration prospect in the region.

Key words: lithologic oil/gas reservoir, pieces-jointed processing, field static correction, refraction static correction, static correction model building

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Static corrections by first breaks tomographic inversion in complex area. Zhang Ji guo and Liu Lian sheng. *OGP*, 2006, 41(4): 383 ~385, 395

The static corrections in complex area have been always the "bottleneck" in seismic exploration. The refraction static correction based on refraction theory is not suitable for the complex area characterized by severely relief surface and rapid changed velocity both laterally and vertically in neither the hypothetic precondition nor the practical application effects. For that reason, the paper recommended the static correlations by first breaks tomographic inversion, and used the method for field acquisition and indoor processing. By using travel times of first breaks on seismic records to compute the distribution of velocities in the media, that improved the precision of near surface model building and achieved good effects in practical production.

Key words: complex prospecting area, static corrections, seismic exploration

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3 D VSP ray tracing based on volume element model. Bian Ai fei, Yu Wen hui and Chen Guo jin. *OGP*, 2006, 41(4): 386 ~389

Based on Fermat's principle, the paper uses full-path iterative algorithm to realize 3-D VSP two-point ray tracing in volume element model. The volume element model is composed of blocks, in which the interfaces between blocks represent by continuous function or interpolation at discrete points. The initial value is firstly given for the points of intermediate paths during ray tracing, then the matrix equation of revised values is computed by iterative algorithm, which gains the information with satisfied precision at path points. The paper implements forward modeling for acquisition in 3-D VSP geometry and illustrates the adaptability of the method to block model by ray-tracing results of reflection P-wave and P-SV waver on the targets. The ray tracing precision can be determined according to researched needs. The method can act as auxiliary tool of optimum designing the parameters of 3-D VSP geometry.

Key words: ray tracing, 3-D VSP, full path iteration, volume element model

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Feature and forward simulation of wide angle Reflection. Xu Wen jun, Yu Wen hui and Hu Zhong ping. *OGP*, 2006, 41(4): 390 ~395

For underlying lower velocity layers shielded by high-velocity layers, the wide angle seismic exploration is effective seismic exploration approach. But under the wide angle condition, the phase difference exists between the reflected and incident waves, making the reflection coefficients complex and the feature of wave dynamics very complicated, bringing difficulty to identification, processing and interpretation of practical seismic data. In the conditions that the elastic parameters of medium λ, μ and σ are determined, wave velocity and dense of medium relatively change, the paper, coming from the Zoeppritz equation, uses the method of numeric simulation to simulate the propagation rule of supercritical seismic waves, which showed, when P-wave incident angles are equal to or great than critical angle, the properties of wave change, the reflection coefficients become complex, which made receiving of reflections on surface difficult, but the transmitted S-wave has strong energy that can be used for detection of information in underlying low-velocity layers shielded by high-velocity layers. It is proved, by using 4-order NMO formula with anisotropic parameters (Alkhalifah method, Hake formula and Castle formula) to carry out correction for seismic data with large offsets, the corrected effects of high-order NMO formula with anisotropic parameters are obviously superior to that of ordinary NMO formula at large offsets.

Key words: wide angle reflection, high-order NMO, stretch distortion, Zoeppritz equation

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Buildup of complex geologic models in continental

fault depression basin and their forward simulation. Han Wen gong and Shen Cai yu. *OGP*, 2006, 41(4): 396~401

Using similar thought as Marmousi model for demonstration of seismic approach and taking structural configuration, formed by multi-period tectonic movement and 6 typical structural models in Jiyang fault depression basin as studied objects, the paper compressed the typical geologic feature of Shengli Oilfield into one model, i.e. complex geologic model in continental fault depression basin, simply called "Shengli Oilfield typical model". The paper expounded the concrete model-building process and method, i.e. first to create structural models and then to build up stratigraphic and lithologic models. The paper also introduced the forward simulation of Shenli Oilfield typical model and application of their data volume to study prestack depth migration and design of geometry. The application effects showed the method has good application prospect.

Key words: seismic forward simulation, continent fault depression basin, complex geologic model-building, Shengli Oilfield typical model, Marmousi model, prestack depth migration

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Identified approach of palaeochannel sand body in Hailaér basin. Li Qing ren, Chen Shou tian, Zhang Cai and Li Zhan lin. *OGP*, 2006, 41(4): 402~404

Based on 3-D high-precision seismic data in northwest part of Beér sag, Hailaér basin and through analyses of seismic attributes in time and frequency domains, the paper studied the variation and distributing law of channel sand bodies and summarized a set of approaches using seismic attributes in time and frequency domains to identify the palaeochannel. Among these attributes, the horizons following attributes sensitive to channel sand body mainly include mean-square root amplitude, gradient of reflection intensity, effective bandwidth and instantaneous frequency. The underwater split-flow channel sand body and river mouth bar sand body have been found by using this identifying approach, which provided concrete objects for deployment of lithologic exploration in this region.

Key words: analysis of seismic attributes, time domain, frequency domain, palaeochannel, coherent data volume, Hailaér basin

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Discussion on several issues about seismic sedimentology. Dong Chun mei, Zhang Xian guo and Lin Cheng yan. *OGP*, 2006, 41(4): 405~409

The seismic sedimentology considers that seismic events are characteristic going across time surfaces. There are a few of practical techniques to be studied about seismic sedimentology. The current used main techniques include 90° phase transform, strata slicing and frequency-division interpretation. After initial application and study of these techniques, the paper considered the angles seismic phases rotated are decided by the seismic phases associated to high-frequency sequence interface of targets, so the phase rotation maybe is not 90°. Meanwhile, the 90° phase rotation could not really improve the resolution of seismic data. Strata slicing is more approaching to time surface than time slice and horizon slice, but the strata slicing technique doesn't consider the change of sedimentary velocity rate with time. The vertical density of strata slicing and its reflected real information are limited in seismic resolution. So, it needs comprehensive analysis of geologic information reflected by strata slicing. It should combine frequency-division interpretation with time-frequency analysis, when using frequency information for stratigraphic sequence, because the former puts emphasis on considering the difference of geologic information reflected by using different frequency band; while the latter pays more attention to strata cycle reflected by the change of frequency vertically.

Key words: seismic sedimentology, time-crossing, attribute of seismic event, 90° phase transform, strata slicing, frequency-division interpretation

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Development feature of sandstone/gravel stone fan and reservoir evaluation in Lijin oilfield. Qi Xue

jing. *OGP*, 2006, 41(4): 410 ~ 414

Upper Es_4 ~ Lower Es_3 near shore submarine fans are major exploring targets currently in Lijin oilfield. In the paper, the study of factors, controlling fans development and rule of reservoir distribution, showed the fans distribution range is controlled by lake basin evolution, palaeogeomorphic feature and border fault pattern. In combination with various analytic and laboratory data, the study of microscopic feature and diagenesis evolution of reservoir determined the reservoir is in A stage of post diagenesis and has mainly involved compaction, cementation and dissolution. On that bases, the main factors affecting reservoir property are clarified, that are structures of rocks, shale content and diagenesis.

Key words: near shore submarine fan, reservoir evaluation, diagenesis, basin evolution, Dongying sag, steep slope zone

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Study of approaches and seismic monitoring water drive front in oilfields of eastern China. Shi Yu mei, Liu Wen lin, Hu Run miao. *OGP*, 2006, 41(4): 415 ~ 422

Based on the basic rule of fluid change in water drive reservoirs, a great number of water drive experiments and statistic results of logging data in two giant oilfields of eastern China, the paper discussed in detail the oil and water migrating feature in a process of water drive for forward and inverse rhythmic reservoirs, summarized the changes of reservoirs in physical parameters (such as porosity, pressure, fluid property) and their influence on acoustic parameters for long-period water injection recovery oilfield, expounded the feasibility using seismic techniques for monitoring the water drive front in different sedimentary rhythmic reservoirs. The definition of water drive front was given on that bases and the method of time-lapse seismic monitoring water drive front was presented. The feasibility and effectiveness of the method was proved by study of synthetic seismic data of 2-D and 3-D water drive models, at the same time, the distribution of by-passed pocket of oil can better be predicted by seismology if combining the water drive front monitoring with the results of initial reservoir description.

Key words: time-lapse seismic, reservoir rhythm, water driver front, feasibility, singular value analysis

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Using generalized S transform technique to predict sandstone reservoir. Wang Bao jiang, Wang Da xing, Yu Bo and Gao Jing huai. *OGP*, 2006, 41(4): 423 ~ 425

On the basis of wavelet transform and S transform, through popularizing basic wavelet, the basic wavelet containing 4 kinds of unknown parameters (amplitude, energy attenuation rate, energy-delay time and apparent frequency) was constructed, realizing generalized S transform. The advantages of generalized S transform are the stack sections can be directly transformed into strata reflection sections without participation of logging data during the processing, which can carry out seismic phase interpretation straightforward on the sections and also can study the sedimentary facies if combination with drilling geologic data. The cases in both model computation and real application showed the generalized S transform can precisely determine the location of reflection interface of strata and identify the structure of thin reservoir.

Key words: generalized S transform, basic wavelet, energy attenuation rate, energy relay time, apparent frequency

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Application of multi-component seismic exploration in Daqing prospecting zone. Wang Jian min, Fu Lei, Zhang Xiang jun, Li Xiao guang and Liu Shao xin. *OGP*, 2006, 41(4): 426 ~ 430

Using geologic model designed by P-wave and logging data in Xingcheng area to perform forward modeling of multi-component seismic data, the paper, by optimized geometry and construction parameters and according to mechanism producing

the P wave and converted wave, carried out the field exercises and acquired high-quality multi-component seismic prospecting data. The processed multi-component data characterized by abundant wavefield information and distinctive feature of inter-layering wave groups were acquired by negative offsets inversion of horizontal component, CCP gathers stack, velocity analysis and NMO correction. Using interpretation thought: making synthetic seismogram →wave mode identification and layer correlation→ time compression →computing attributes section, the interpreted results coinident to drilling results were obtained.

Key words: multi-component, seismic exploration, digital geophone, converted wave, processing, interpretation

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Discussion on taking values of Thomsen parameters in transverse isotropic media. Ma De tang and Zhu Guang ming. *OGP*, 2006, 41(4): 431 ~ 438

The paper analyzed and discussed the functional relationship among phase velocity, group velocity, group angle and phase angle in transverse isotropic media given by Mr. Thomsen (1986); defined a parameter C_0 relative to V_P/V_S ratio in vertical directions; illustrated that Thomsen parameters ε, δ and C_0 are not totally independent, their evaluated range should be constrained by each other. The paper pointed out the evaluated ranges of Thomsen parameters ε, δ and C_0 should satisfy this constrained interrelation theoretically; proved the group angle of q P wave $\varphi(\theta)$ is monotonously increasing function of phase angle θ and have consistent monotonicity of group velocity and phase velocity of q P wave versus phase angle θ; gave monotonous conditions of group angle of q SV wave $\varphi(\theta)$ versus phase angle θ and summarized the monotony of group velocity and phase velocity of q SV wave versus phase angle θ is not always consistent. Analyzed results mentioned above provided a theoretical basis for using linear or non-linear interpolation method to determine the phase angle as well as phase velocity and group velocity relative to the known group angle.

Key words: transverse isotropic, phase velocity, phase angle, group velocity, group angle, Thomsen parameters

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Exploration prospect of litho-stratigraphic oil/gas reservoir in Haila'er basin. Wang Jian min, Liu Jie lie and Chen Shou tian. *OGP*, 2006, 41(4): 439 ~ 441, 457

The paper used 3-D seismic data in Haila'er basin to identify three kinds of slope break zones—faulted slope break, sedimentary slope break and erosion slope break, among which the faulted sloped break is more developed and the latter two slope breaks has limited distribution in Haila'er basin; the litho-stratigraphic reservoirs were divided into 7 subclasses according to main genesis of oil/gas reservoirs, among which the gentle-slope faulted slope break zone controls lihtologic updip pinchout oil/gas reservoir, lithologic lens reservoir and overlap reservoir; the steep-slope faulted slope break zone controls sand/gravel stone reservoir and overlap reservoir; buried hill reservoir is developed above the faulted or erosion slope break zones, inconformity and faulted slope break control jointly inconformity reservoir; palaeochannel sandstone reservoir is generally located in the sub-sag near slope break zone. It is thus clear that the slope break zone and surroundings are the fields of interest for developing litho-stratigraphic oil/gas reservoirs.

Key words: Haila'er basin, lithologic reservoir, stratigraphic reservoir, slope break zone, exploration prospect

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Seismic coherence technique based on volume attributes. Duan Yun qing, Qin Tian, Zhang Lian meng and Gao Feng chang. *OGP*, 2006, 41(4): 442 ~ 446

The common acquired seismic attributes mostly rely on single channel filtering. The volume attributes are to use adjacent domain analysis and multi-channel analysis for computing the attributes for each sub-volume from seismic data volume. Many important parameters feathering reservoir, such as faults, micro-fractures, lithology and li

thologic facies etc., can be gained from seismic coherence computation based on volume attributes. The display by overlying the coherence data, stratigraphic dip and azimuth can more distinctively describe the subtle variation of geologic attitude, which provides a powerful technical tool for geologists to research the structural deformation (folds and fractures) and variation of lithology. The practical processing of seismic data shows there is bright prospect for the application of the method to detect micro faults, fractures and lithologic variation.

Key words: seismic volume attributes, seismic subvolume, coherence analysis, adjacent domain analysis, multi-channel filtering

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Application of Niche Genetic Algorithm (NGA) on AVOA inversion. Lu Ming-hui, Peng Li-cai, Yang Hui-zhu and Zhang Hai-yun. *OGP*, 2006, 41(4): 447~450

Using transversely isotropic model with horizontal axis of symmetry (HTI) to study the fractured oil/gas reservoir, P-wave amplitude variation with offset and azimuth (AVOA) appears strong azimuth anisotropic feature. Based on the P-wave reflection coefficients formula in HTI media model presented by Mr. Ruger, the paper uses the relative differences between the P-wave coefficients of datum line and other two lines crossing over the datum line with 45 and 90 respectively to evaluate the fractured azimuths; meanwhile, introducing niche genetic algorithm to perform inversion of differences of the coefficients between datum line and the line crossing over the datum line with 90, which obtains higher precision P-wave velocity-to S-wave velocity ratio and Thomsen anysotopic parameters.

Key words: AVOA, inversion, fracture detection, niche genetic algorithm, HTI

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Marine Electromagnetic Approach. He Zhan-xiang, Sun Wei-bin, Kong Fan-shu and Wang Xiao-fan. *OGP*, 2006, 41(4): 451~457

After more than tens years' efforts, the marine electromagnetic exploration has gone to a practical stage. The effects of marine electromagnetic exploration have been widely paid attention by industry day by day. Based on the literature of marine electromagnetic approach and papers published in international conference in recent years, the paper expounded the marine electromagnetic approach in following aspects: basic principle, acquisition, processing and interpretation techniques as well as application cases, which hopes to bring to industry's and researchers' attention and push the marine electromagnetic exploration to be developed at home

Key words: marine electromagnetic exploration, acquisition technique, processing and interpretation techniques

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Reduction of Gravity Data to a Horizontal Plane by Using Wavelet Compression. Liu Tian-you, Liang Yun-ji, Yang Yu-shan and Feng Jie. *OGP*, 2006, 41(4): 458~461, 475

Equivalent dipole layer method is currently considered as most complete reduction of gravity data to a horizontal plane theoretically, but the method cannot process the practical data with a giant amount of data. The main reason lies on difficulty to deal with a large scale and high-order integral equation. The paper uses wavelet compression algorithm to realize the compression and order-reducing solution of large scale Fredholm integral equation. The theoretical model computation showed the reduction of gravity data to a horizontal plane can reach a very high precision when the compression ratio is 40.5%. The paper also discussed the influence of different compression ratio on the reduction of gravity data to a horizontal plane and illustrates the application effect of the method by the result of the reduction of gravity data to a horizontal plane in Y oilfield of southern China.

Key words: gravity, the reduction of gravity data to a horizontal plane, Fredholm integral equation, wavelet compression algorithm, oil/gas exploration

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Relationship between Dongying delta of Dongying depression and formation of salt shale structure in central uplift and meaning in exploration of subtle oil/gas reservoir. Sun Chang xu, Cui Yong gang, Luo Wen sheng and Qu Chang sheng. *OGP*, 2006, 41(4): 462 ~ 467

Dongying delta is typical river controlled delta developed along the long axis direction of Dongying sag. Many deltas have been developed in the east and south parts of Dongying sag in mid-latter stage of fault depression, among which the Dongying sag is the broadest developed area, the longest developed time and has the biggest influence on palaeotopography and sedimentary action. The study by using fine 3-D seismic, logging and drilling data showed the Dongying delta of Dongying sag has important meaning for the formation of central uplift zone, especially for the salt shale structure in Liangjialou-Xianhezhuang structural zone. It is considered, by using the basic principle of high-resolution sequence stratigraphy and structural analysis and through combining the prograding process of Dongying delta with upper bend action of salt shale structure, that significant thickness of delta prograding body is trigger factor of forming the salt shale structure. The more important is, because of the formation of salt shale structure, the sedimentary slope suddenly become steep, adding the progressively prograding of delta. Finally, the gravity slumping and diapir movement lead to form the growth fault and further form the structural slope break zone: on the one hand, slumping turbidite bodies have been formed in delta front; on the other hand, the sand bodies relative to structural slope break, for example the lower fan system, have been formed. Creating the relation mode among the delta prograding body, salt shale structure and structural slope break has important meaning for exploration of subtle oil/gas reservoir.

Key words: Dongying delta, salt shale structure, growth fault, structural slope break, slumping turbidite body in delta front

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Re knowing about exploration of lithologic oil/gas reservoir in maturing field. Lu Gang chen, Shi Hui min, Liu Yi ying, Wen Yan Jun, Li Yu hai, Li Ting hui and Cao Xue feng. *OGP*, 2006, 41(4): 468 ~ 475

Dagang oilfield has experienced more than 40 years´ exploration and has entered into lithologic oil/gas exploration stage of maturing zone. The source, accumulation and trap conditions in maturing zone are superior, but relationship between the structure and reservoir in maturing zone is complex, therefore, the ideas and work flow of lithologic exploration in slope area should be adopted for exploration in maturing zone. During re-knowing and evaluating the analyzed works in maturing zone, it should, on the basis of fully using abundant drilling data in maturing zone, develop fine study of reservoirs, including partition of stratigraphic sequence, identification of lithologic facies and description of reservoir on plane. The practice achieved distinctive effects, opening up a new prospect for exploration in maturing zone.

Key words: slope area, lithologic oil/gas reservoir, fine study of reservoir

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Talking again about Paleozoic oil/gas exploration prospect in Lingqing depression. Yang Ke sheng, *OGP*, 2006, 41(4): 476 ~ 483

The Paleozoic in lingqing depression and Ordos basin are North China Kraton Paleozoic structural layer and have similar petroleum-geologic condition to Paleozoic in the Suqiao buried hill situated in same basin. The paper carried out the correlation and analysis of basic conditions of petroleum accumulation, such as genesis, reserve, cap, trap and preservation, for Lingqing depression and Ordos basin, and the anticlines and half-anticlines, having good preserved conditions in Paleozoic of Lingqing depression, are the field of interest for formation of petroleum reservoir. They should become firstly selected objects of petroleum exploration in future on in this region.

Key words: Lingqing depression, Paleozoic, Ordos basin

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Study of 3-C induction log system. Dang Rui-rong, Qin Yao, Xie Yan and Wang Hong-miao. *OGP*, 2006, 41(4): 484~488

In worldwide, thin and interbedded reservoir occupied 30% of total discovered reservoirs. The thin and interbedded reservoir is also called anisotropic reservoir that occupies more proportion in China. Ordinary electromagnetic logger only measures resistivity in horizontal direction and easily underestimates and fails to measure the interactive thin reservoir with low resistivity and low contrast. The 3-C induction log system can directly measure both horizontal and vertical resistivity of strata and also measure the dip angle and azimuth of strata. The paper introduced structure and measuring principle of coil system in 3-C induction logger, expounded two forward and inversion methods of anisotropic strata: staggering grid finite-difference method and finite-element method and finally further discussed application prospect of 3-C induction log system.

Key words: induction logger, 3-component (3C), anisotropy, measuring principle, forward simulation, inversion

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Relationship between bin size and inline resolution. Xiong Jin-liang, Yue Ying, Yang Yong, Xue Guang-jian, Yue Yun-fu and Wang Guang-qi. *OGP*, 2006, 41(4): 489~491

The resolution is an important technical index measuring the quality of seismic data. The job of improvement of inline resolution has been gradually transited from traditional acquisition and processing methods to that mainly taking smaller spatial sampling rate of wave field. In recent years, the people have two kinds of knowledge for improvement of inline resolution by minor bin size acquisition technique: one is to consider the formula, expressing the relationship between the highest Nyquist frequency and bin size in 3-D seismic exploration, can express the relationship between bin size and inline resolution; the other is to consider the migration can improve inline resolution. For that reason, analyzed systematically the relationship between bin size and inline resolution by practical data and forward physical models, the authors pointed out that the minor bin size itself does not improve the inline resolution and the nature of improving inline resolution is to improve S/N ratio in high-frequency ends by bin size stack and then to improve inline resolution.

Key words: bin size, inline resolution, forward physical model, migration

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