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ABSTRACTS

Design of special geometry and application in Qian'an urban area. Yang Guangda, Guo Dongqi, Li Zhonghui and Zhou De. *OGP*,2005,40(4):377 380

Jilin surveying area is mature prospecting area, but there exist many urban areaswhere the seismic exploration has not been carried out. Using 3D swath special geometry can better conduct the seismic acquisition in complex surface conditions. The paper expounded the design of special geometry in Qian'an urban area and its applied effects. The missing of the shot points in urban area resulted in missing of short offsets that made the shallow data incomplete, which is difficult to acquire the acquisition targets by using normal geometry. Infilling receiver lines in urban area can effectively compensate the missing short offsets because of shortage of shot points in urban area, which guaranteed the completeness of shallow data and also can effectively increase folds and suppress environmental noises in urban area at the same time; the deep weak reflected energy caused by small charge size in urban area can be complemented by infilling shot points outside urban area that can effectively increase the deep reflected energy. The method is of benefit to link up the seismic data inside and outside the urban area which is of benefit to data processing and convenient to field construction. The practice showed that using this special geometry could obtain good acquisition effects.

Key words special geometry, fold, bin, offset, obstacle

NMO correction of wide angle reflection by mean errors value method. Xia Hongrui and Ge Chuanqing.*OGP*,2005,40(4):381 385

Starting from the formula of NMO correction of wide angle reflection having the correction of truncation errors, the paper analyzed the causes of NMO errors and pointed out existed problems during the process of evaluating the residual errors. On that basis, according to the two objective realities that the 4th order Taylor truncation equation and 6th order Taylor truncation equation are situated above and bellow the true travel time curve of reflections separately and that the two curves having higher similarity closely approaches each other when one curve approaches to the other, using optimum curve that has similar errors when 6th order equation approaches to the 4th order equation and is situated bellow the true travel time of reflections and computing the mean values both for 4th order equation and 6th order equation can eliminate the influence of truncation errors existed in application of Taylor truncation equation. The method can accurately approach the travel time of reflections and avoid the evaluation of residual truncation errors. The paper tested the method by using theoretical models and practical data.

Key words wide angle reflection, NMO correction, high order truncation errors, similarity of curves, approach to curve by curve, approximating level, indirect approach

Interactive velocity analysis on CFP gathers. Xin Kefeng, Wang Huazhong, Ma Zaitian and Zheng Wei. *OGP*,2005,40(4):386　390　399

Based on double focusing imaging theory, the paper presented the method of interactive velocity analysis on common focus gathers (CFP),which is used to build up preliminary imaging velocity model and finish the transform from time horizons to depth layers and from velocity field in time domain to that in depth domain. The method follows the principle of travel time being equal to determine the velocity of horizons and takes optimized imaging quality as judge standard of velocity correctness. The key ring transformed from theory to practice for the method of interactive velocity analysis on CFP gathers is computation of CFP response curves and time shifted curves according to the results of time interpretation, which is also the new contribution of the paper in theory and practice. The method is characteristics of flexible implementation, stable procedure and accurate analyzed results. The stableness, effectiveness and practice of the method has been confirmed by the velocity model building of seismic data in Daqing model and real seismic data.

Key words　common focus point gather, velocity analysis, interaction, pre-stack depth migration

3D shooting ray tracing sub triangle method. Xu Tao, Xu Guoming, Gao Ergen, Jiang Xianyi and Luo Kaiyun. *OGP*,2005,40(4):391　399

Ray tracing method of seismic wave has wide application in seismic data processing and its precision and computational efficiency directly determine the quality of data processing. Therefore, constantly improving the ray tracing method has always been the human's studied hot spot. Generally, the people considered that shooting method is rapid and accurate method for solving ray tracing problem between two points. On that basis, using area coordinate of triangle, the paper presented several shooting ray tracing methods: simplicity method, triangle subdivision method, triangle partition method and sub triangle method. The studied results showed that the sub triangle method is characteristics of fewer shooting numbers, rapid convergence and high precision. The 3D ray tracing theoretical studies and real cases presented by the paper showed that using correction of directional components of shooting has better results by comparison with direct correction of shooting angles when shooting correction is carried out.

Key words　ray tracing, shooting method, sub triangle method, directional component

Processing technique of mix factor in time lapse seismic cross equalization method. Jin Long and Chen Xiaohong. *OGP*,2005,40(4):400　406

In practical seismic exploration, it is difficult to make two repeated surveys completely consistent because of the influence of surveying conditions. The paper defined the difference of seismic responses resulted from fluid and oil gas reservoir as anticipant difference and from other factors (non reservoir) as non anticipant difference. In order to effectively protect the anticipant difference and remove the non anticipant difference, the paper first simulated the synthetic seismograms having differences in single factors such as amplitudes, times, phases and frequencies appeared in different times and differences in mix factors, then used cross equalization technique for separate correction of single factors such as amplitudes, times, phases and frequencies and correction of mix factors on synthetic seismograms. The results of corrections showed that the operators of amplitude, time, phase and frequency in computed cross-equalization technique can effectively remove the non-anticipant difference and better restore the anticipant difference. It is further showed the correctness and effectiveness of the conclusion by practical data processing and laid the foundation for the following application in real data processing.

Key words　cross-equalization technique, forward modeling, correction operator, single factor

Analysis and application of pre-stack depth imaging technique. Li Lailin, Wu Qingling, He Yuqian and Wei Dali.*OGP*,**2005,40(4):407 410 416**

The paper expounded the development of seismic migration technique from two aspects   principle and technique, analyzed the differences of different migration techniques and presented three expressions of imaging conditions. On the basis of expounding model building technique of pre-stack depth imaging velocity, the paper presented following basic principles that the velocity model building should follow: it should choose the events having good continuity, the thickness of beds should not be too thin and differential interval velocities of adjacent layers should greater than 10%;   it can adequately reduce the interpretation of target lines in gentle parts of structures and increase the interpretation of target lines when the structures are complex;   it should make modification of interval velocities ac cording to picked time horizons in ordinary migrated sections, making efforts to keep smooth variation of interval velocities both in vertical and in lateral directions and align the CRP gathers. It was showed by the applied cases of pre-stack depth imaging technique in Hailar area that the effects of pre-stack imaging technique are significantly superior to that of post-stack migration.

Key words   pre-stack, depth, CRP gather, zero offset

Detection of gas reservoir by using seismic attenuation attributes in wavelet scale domain. Li Hongbing, Zhao Wenzhi, Cao Hong, Yao Fengchang and Shao Longyi. *OGP*,**2005,40(4):411 416**

Starting from the equation of instantaneous parameters and scale energy in wavelet domain, the paper considered that the energy attribute and instantaneous attributes in wavelet scale domain can represent attenuation character of seismic signal in a certain scale scope and defined them as attenuation attributes of seismic wave in wavelet scale domain. Its meanings are as follows: the scale of scale energy of real seismic signal can reach maximum at extreme point and scale energy of reflected signal exponentially decreases with the decrease of scale within a "band-pass" scope starting at that scale;   the scale energy computed within the "band-pass" area along the small scale direction starting in the scale at extreme point is called as energy attenuated attribute of seismic wave scale, the instantaneous parameters sections in relative scale are also classified as the category of attenuation attribute in wavelet scale of seismic wave. The theoretical study and analysis of cases showed that the attenuation attribute of wavelet is more sensitive to gas reservoir by comparison with ordinary instantaneous amplitude attribute, the detective effects by attenuation attribute of wavelet is obviously better than that by ordinary instantaneous amplitude attribute when detecting the thin gas bearing beds or on noise bearing seismic records.

Key words   wavelet domain, attenuation attribute, instantaneous attributes, gas bearing bed detection

Analysis of PSV wave AVO response feature. Sun Pengyuan, Sun Jianguo and Li Yanpeng. *OGP*,2005,40(4):417　422

The paper first reviewed the P-P wave AVO response feature and its classification, then systematically expounded the P-SV wave AVO response feature from P-SV wave reflection coefficients and amplitude feature, normalized P-SV wave reflection coefficients and intercept gradient feature and relationship between the variation trends of strata parameters and AVO types. The paper gained the following knowledge by selecting lithological parameters of 4 AVO types given by Castagna and Hilterman and using Zoeppritz equation to compute the PSV reflection coefficients: there is more complex P-SV wave AVO response feature in different kind of gas beds, using single reflection coefficient curve and amplitude feature cannot differentiate from each other among 4 AVO types, which indicated the insensitive to fluids component of reservoir by P-SV wave AVO response; the normalized reflection coefficient curve is monotonic character when introducing the conception of pseudo converted wave impedance and amplifies weak AVO anomaly, which showed that the normalized reflection coefficients in vertical incidence are monotone increasing with incident angles for ,   and   AVO types either in water bearing reservoir or in gas bearing reservoir; for   AVO type of gas beds, the feature of fluids in the reservoir does not affect the variation trends of reflection coefficients that are positive values and monotone decreasing with incident angle;   and   types of gas beds are characteristics of negative intercepts and positive gradients, the intercepts and gradients of   type of gas beds approach to zero and   type of gas beds are characteristics of positive intercepts and negative gradients. The paper uses PSV wave AVO intercept gradient theory to implement the intercept gradient analysis for different AVO types and 25 gas(or oil)bearing sandstone samples given by Castagna, which further proved the P   SV wave AVO response feature and the ability to identify different gas beds. The study in the paper has important meaning for AVO forward modeling, replacement of reservoir fluids, AVO analysis and parameters inversion of multi waves.

Key words　AVO response feature, reflection coefficient, P-SV wave, intercept-gradient, pseudo converted wave impedance

Analysis and appreciation of wide/narrow azimuth exploration cases(   ).Ling Yun, Wu Lin, Chen Bo and Lin Jixiang. *OGP*,2005,40(4):423　427

The studies of the predecessors showed that current isotropic and anisotropic migrated imaging theories are difficult in effectively eliminate the influence of anisotropic faulted belts, for example, the issue of smeared imaging for faulted zone (shadow area) can be often met in pre-stack depth migration processing. For that reason, the paper carried out appreciated study of effects of wide/narrow azimuth survey by using 3D full azimuth seismic data acquired on piedmont fracture belts of Tulufan Basin in the west of China and taking fracture belts and its relevant fractured reservoir as exploration targets. The data processing in the study was ordinary processing in time domain with relative amplitude reservation. It is considered through analyzing the differences between seismic attributes information such as stack sections with different azimuth angles, gathers with same CDP analyzed points and coherent data volume in different azimuths that in a condition of comparatively plain strata, relative simple velocity fields and having certain signal to noise ratio, using wide azimuth (aspect is greater than 0.5) survey can obtain better imaging results of multi oriental minor faults than by narrow azimuth survey in developed fracture belts and can also obtain more distinct faulted zone and spatial scope of reservoir at the same time.

Key words　azimuth, HTI anisotropic medium, seismic attributes, fracture belt, fractured reservoir

Influence of Biot slow wave in layered saturated porous medium. Mao Yadan. *OGP*, **2005, 40(4): 428 432 443**

Based on Biot theory, the paper conducted numeric modeling for P-wave (effects of P wave dispersion, Biot global fluid and slow wave being considered) and visco-elastic pores (effects of slow wave being neglected).It is discovered by correlation of numeric modeling results of two models that the equilibration action of liquid pressure between layers of sedimentary basin (Biot wave) can produce significant attenuation for P-wave in low frequency scope; the thickness of layers in medium has to vary from several centimeters to tens centimeters if the attenuation takes place within a frequency band of shallow seismic exploration (from tens to hundreds Hz); the more compliance the medium, the larger the porosity and the better the permeability, the bigger the influence of slow wave; in high frequency band, the effects of slow wave produced on the interfaces on the P wave dispersion will be bigger if the layers are enough thick and compliance of medium is enough good.

Key words   layered medium, Biot slow wave, numeric modeling, Kennett reflection method, Biot
                global wave, P-wave dispersion

Description of delta sand body reservoir and oil bearing analysis in north slope of Chengjiazhuang uplift. Zhuang Bo and Liu Yuqin. *OGP*,**2005,40(4):433 437**

The Ed delta deposition is developed in the gulches and valleys of the north slope of Chengjiazhuang uplift. Through the analyses of paleo-geomorphology, electric character of rock, seismic reflection feature of sand body and sedimentary facies, the paper considered that Ed sand body is deposition of delta front mouth bar. Using 3Dvisualization technique, the paper conducted the description of spatial distribution of delta foreset sand body;15 foreset sand bodies were discovered by interpretation, which is imbricate arrangement from south to north. On that basis, the oil bearing analysis of the sand bodies was conducted by cluster analysis technique, which considered   there some parts of delta foreset sand bodies that are oil bearing sand bodies and oil gas mainly accumulates in the high position of sand body;   the height of oil column of sand body is shorter and filling level is lower;   the reservoir is mainly controlled by the lithology of sand body and paleo-geomorphology has some influence on oil bearing characters of sand body;   the sand bodies in overlap belt on both sides of gulches and valleys have good oil bearing feature.

Key words   reservoir description, oil bearing analysis, delta deposition, seismic reflection feature,
                cluster analysis, paleo geomorphology

Braided channel characters in palustrine environment and its identified methods. Zou Xinning, Sun Wei, Zhang Mengbo, Wan Yujun and Liu Yuanying. *OGP*,2005,40(4):438 443

The lithological gas reservoir of P2h2 sandstone in Ordos basin belongs to braided deposition palustrine background. The sandstones are mainly coarse, medium coarse and medium sandstones. Clumpy bedding and tabular cross bedding are the main types. The sedimentary sequence generally presents a positive cycle characterized by upper—coarse and lower—fine. Channel bar sedimentary micro facies is most important effective sedimentary unit of the reservoir, he inner structure is more uniform and Gamma ray curves are characterized by more smooth and box with low amplitude. The configuration of channel seismic reflections shows lenticular or mounded form and belongs to bad continuity, medium amplitude and onlap filling seismic facies. In the earlier days of development characterized by fewer drilled wells and larger well spacing, integrative application of seismic, geologic, logging and drilling data and using cluster analysis of seismic waveform and restoration of paleo-structure to identify channel, which obtained planar distributed feature of P_2h_2 braided channel. The optimized construction blocks and arranged development wells on these grounds achieved good results.

Key words reservoir prediction, braided channel, Ordos basin, seismic facies, sedimentary facies feature, earlier days of development identified methods

Problems existed in 4D seismic monitoring of continental thin and interbedded reservoir and suggestions. Yun Meihou, Ding Wei and Wang Xinhong. *OGP*,2005,40(4):444 450

4D seismic monitoring technique has been successfully applied in management of marine oilfields, but few cases showed the success of the method in land oilfields. On the basis of carefully analyzing the condition of reservoir and seismic condition, the paper pointed out the problems existed in 4D seismic monitoring of continental thin and interbedded reservoir in China and presented some suggestions. The study considered that the petrophysical study and feasibility demonstration are the bases of implementing the 4D seismic monitoring test of continental thin interbeds; improving repeatability of 4D seismic data is the key; the study and application of pre-stack seismic attributes are major developed direction of 4D seismic interpretation; multi wave and multi component seismic techniques are very important tools; current 4D seismic monitoring tests of continental thin and interbedded reservoir should be first aimed at monitoring of heated heavy oils recovery, gas injection or CO_2 injection recovery and water flood recovery for high porous and unconsolidated or poor consolidated sand.

Key words thin interbed,4D seismic exploration, reservoir monitoring, water flood recovery, heated heavy oils recovery

Effects using 3D high resolution seismic exploration for subtle reservoir. Chen Jialiang Hu Runmiao. *OGP*,2005,40(4):451 453

QK sag is one of biggest second level sag in Huanghua depression. There have be more than 30 years of explored history on west slope of QK sag. It cannot verify the distributed regularity of internal thin sand bodies in Es3 target that cannot meet the need for finding subtle reservoir because of poor resolution of former 3D seismic data in this area. For that reason, by the aid of sequence stratigraphic knowledge and 3D high resolution seismic data as well as 3D constraint seismic inversion data, the paper probed a new mode of exploration of subtle oil/gas reservoir. The dominant frequency of 3D high resolution seismic data has been increased from original 25 Hz to 50 60 Hz and even reached to 70 Hz for shallow layers after high resolution processing. The dominant frequency in Es3 target can also be reached to above 40 Hz. The updip sandstone pinch-out is clearly showed in internal Es3 target on seismic sections after logging constraint seismic inversion, which created condition for identifying subtle traps.

Key words subtle oil/gas reservoir, sequence stratigraphy, high resolution seismic exploration, seismic inversion

Study of method of hybrid optimum automatic residual static corrections. Gou Liang, Peng Zhenming and Wang Kebin. *OGP*,2005,40(4):454 458

The nature of computation of residual statics is non linear optimum problem. Faced with the disadvantages of slower computational speed and lower precision that are characters using genetic algorithm or simulated annealing algorithm alone to compute residual statics, the paper presented an automatic residual static corrections characterized by hybrid global optimum automatic residual static correction. It is seen from test computation of model data and real data in some areas of the west of China that the hybrid optimum technique is superior to other methods both in computational speed and in precision of solution.

Key words hybrid optimization, annealing, genetic algorithm, global search non linear inversion, residual static corrections

Method of identifying oil bearing ability in channel sand body. Wang Yonggang, Yue Youxi, Cao Danping and Wang Xuejun. *OGP*,2005, 40(4):459 462

The prediction of oil bearing ability in sand body has certainly some difficulty and risk. Nevertheless, because the oil bearing ability in all kinds of sand bodies always has some characters and regularities, therefore, in a condition of following the geologic feature and regularities, it can use multi information such as geology, geophysics and reservoir engineering to scientifically and reasonably predict oil bearing ability in sand body after analyzing the geologic and geophysical conditions of oil bearing ability in sand body. The paper mainly used the results of oil bearing ability separately predicted by optimized seismic attributes, porosity predicted results, neural network method and support vector machine method to carry out integrative judge of oil bearing ability in channel sand bodies situated in upper part of Eg on the north slope of Chengdong uplift, which achieved preliminary success.

Key words channel sand body, seismic attributes, prediction of porosity, prediction of oil bearing ability, fuzzy neural network method, support vector machine method

Variation of natural potential curves and interpretation of pore pressure in Daqing oilfield reservoir. Wang Liansheng, Yan Shoubin and Shen Xia. *OGP*,2005,40(4):463　466

Along with development of Daqing oilfield, the amplitude and configuration of natural potential of reservoir took place large variation in comparison with that in the initial stage of development, the change of the master slave position of diffusion absorption potential and filtration potential constituted natural potential also took place. The reasons resulted in these variations lay in sharp variation in fluid salinity and fluid pressure of reservoir after long period water injection. The pressure state of reservoir could be judged and size of pore pressure could be precisely interpreted by using the correlation of filtration potential with differential pressure. In view of the above, it summed up a method that is suitable to interpret pore pressure of sandstone reservoir in the later stage of water flood recovery, which is called natural potential method.

Key words　oilfield development, fluid nature,natural potential, interpretation of pore pressure, mathematic model

Application of complex apparent resistivity (CR) method in prediction of oil/gas. Su Zhuliu, Wu Xinquan, Hu Wenbao, Zeng Jun,Gong Jianqing, Qing Zhaoqiang and Yan Liangjun. *OGP,* 2005, 40(4):467　471

There exists obvious polarization anomaly above CE oilfield of Junggar basin, the polarization is greater than 10%,the electromagnetic phase is greater than 2.0 MRD, but the resistivity is generally less than 8.0 $\Omega \cdot m$, so the method of complex apparent resistivity (CR) used for exploration and prediction of oil/gas fields was implemented in surrounding areas of the oilfield. The dipole-dipole configuration was used in field geometry; during the data processing, a new technique separated the induced polarization anomaly from electromagnetic induction effect—reforming spectrum parameter phase stagger fit method was used, which is based on multiplication combination of Cole-Cole model with Brown model. The experimental results showed that CR method could finely describe vertical and horizontal feature of induced polarization anomaly within schedule depth scope in exploration design and provide reliable geophysical basis for well site design. The predicted induced polarization anomaly was confirmed by following drilling practice.

Key words　induced polarization method, complex apparent resistivity, induced polarization spectrum, electromagnetic spectrum, Cole—Cole model, Brown model, reforming spectrum parameter　phase　stagger fit method

Experimental effects of shallow survey in Youquanzi area. Wang Yongtao,Jiang Wenbo and Wang Tianping. *OGP*,2005,40(4):472　477

It is difficult to make certain of suitable shooting layers by ordinary shallow survey methods in Youquanzi area of Qiadam basin because of significant thickness of dry layer on the surface and thick low velocity layers (LVL).In view of above mentioned problems and to match the seismic uphole survey, the study of surveying moisture content in logging core samples, electric logging and high density resistivity method were carried out. The joint surveys for surface structure of two experimental cross lines were implemented by using abovementioned methods, which discovered that 1　2 well parts characterized by high moisture content and low resistivity within the scope of 35 m deep below surface could be still found out, which is suitable for seismic shooting. This set of joint survey method for surveying the subsurface provides a new tool for combination of non seismic and seismic methods.

Key words　Youquanzi area, low velocity layer, lithologic logging, surveying moisture content, electric logging

Structural study of meshwork and carpet like oil gas reservoir forming system in Dongying. Hu Xiangen,Jiang Suhua and Gao Ping. *OGP*,2005,40(4):478 481

The study of meshwork carpet like oil gas reservoir forming system has achieved significant effects in Zhanhua sag exploration. Using the studied results of meshwork carpet like oil gas reservoir forming system in Zhanhua sag, the paper studied the structural feature of meshwork carpet like oil gas reservoir forming system in Dongying sag and divided major storage layers. Through the analysis of compositional structures and sedimentary feature of upper meshwork layers, carper like layers and lower meshwork layers, the oil gas accumulation regularity in middle and shallow layers of Dongying sag has been further further clarified, which pointed out the direction for the exploration and development in Dongying sag.

Key words   Dongying sag, delta, Es2, Es3,storage layer, reservoir

Summary of optimum methods of seismic attributes. Yin Xingyao and Zhou Jingyi. *OGP*, **2005, 40(4): 482 489**

Along with the constant development of detecting seismic attributes techniques, the kinds of seismic attributes also increase continuously. In view of complex relationship between predicted targets and seismic attributes, the seismic attributes sensitive to (or most effective on, or most representative of) targets predicted are not completely identical in different work areas and different reservoirs. For that reason, it has to optimize the seismic attributes. Generally, the optimized processing means that using human experiences and mathematic algorithm to optimize the fewest numbers of composition of seismic attributes characterized by most sensitive to (or most effective on, or most representative of) solved problems. The authors considered that the optimum of seismic attributes should mainly include two parts: preprocessing of attributes and selection of attributes. The paper appreciated these two parts of contents separately, which gave a reference to the researchers who engaged in optimum of seismic attributes.

Key words: seismic attributes, attributes optimization, attributes preprocessing, reservoir prediction