ABSTRACTS

Study on explosion effects of explosive source in soil medium. Lü Shuran and Yang Jun. *OGP*, 2003, 38(2): 113~116

The paper studied the explosion effects of explosive source in soil medium and discussed on the generation and the calculation of explosive cavity, compressed zone, elastic-plastic zone and elastic zone separately, and also analyzed hazard effects of seismic wave exploded by charge. The studied results can be used for design of seismic field operation or for estimation of varies hazard effects generated by explosive source. The calculated results can meet a demand for engineering design.
Key words: explosive cavity, compressed zone, plastic zone, seismic effect of explosion
Lü Shuran, National Key Laboratory of Explosion and Safety Science, Beijing University of Science and Engineering, Beijing City, 100081, China

Design of object-oriented seismic acquisition technique and its application effects in SK area. Duan Weixing, Di Zhixin, Zhang Qinghuai, Liu Bin, Xu Jinxi and Yu Zhihe. *OGP*, 2003, 38(2): 117~121

Object-oriented seismic acquisition technique has been presented because of complicated geologic structure presented in seismic exploration. Because of complicated subsurface geologic structure in SK area, non-uniform offset distribution, small azimuth and lower fold in old geometry resulted in data with poor S/N ratio in Yidong fault system and in buried-hill structure of the area, which is impossible of making subtle structural interpretation and reservoir description . In order to get excellent data in that region, the paper presented an idea that can solve the problems, that is careful object-oriented seismic acquisition design aiming at complicated geologic structure and carrying out a set of high-precision acquisition tools and measures in field production, so that the total quality of data in object area has been greatly improved than it was before, which resulted in seismic sections capable of using for subtle structural interpretation. The real cases of successful application of this acquisition technique in the area showed that the object-oriented seismic acquisition is a good tool for solving the poor data quality in complicated geologic structure area, which has referential value to the acquisition in later similar area.
Key words: object-oriented seismic acquisition, seismic exploration, complicated geologic structure, signal-to-noise ratio
Duan Weixing, Institute of Seismic Exploration, Geophysical Prospecting Company, Niuzhuang Village, Dongying City, Shandong Province, 257100, China

Discussion on seismic acquisition in an area having lower S/N ratio and strong linear interference: preliminary study for seismic acquisition method in west of south Boyang depression. Bai Xuming, Li Peiming, Xing Guodong, Hu Jianqiang, Zhang Yusheng and Zhang Huacai. *OGP*, 2003, 38(2): 122~125

Aiming at "sandwich" style's complicated surface structure in west of south Boyang depression, we use dynamic character of uphole survey in double well to determine optimum shot-hole depth in field operation, which provided a more scientific, straightforward and economic tool for selecting shot-hole depth in the field. Meanwhile, the conception of true or false water table is presented combining a large amount of investigating job for surface structure. The analytic method for trial data having lower S/N ratio by using quantitative analysis tools such as time-frequency analysis and frequency-time analysis and tool using single shot record with pure wave and filtering with predominant frequency band for appreciation of data quality in single shot record provided a use for reference to later analyzing data in similar area.
Key words: uphole survey in double hole, true or false water table, time-frequency analysis and frequency-time analysis, filtering with predominant frequency band
Bai Xuming, Department of Exploration, BGP, Zhuozhou City, Hebei Province, 072751, China

Characteristic analysis of receiver-array in complicated surface conditions. Wang Yonggang, Duan Shimin, Zhu Zhaolin and Cao Danping. *OGP*, 2003, 38(2): 126~130

The paper systematically discussed the theoretical problem of receiver-array and shot-receiver-array in special surface conditions . We acknowl -

edged by theoretical study and field test that in a condition of complicated surface (inclined or relief surface) the passband of directional characteristic curve of the array becomes broaden and the average of suppression band increases when the elevation difference (Δh) between adjacent receivers increases, which degrades suppression effect on surface wave having lower apparent velocity, but there is no obvious change in directional character of the array when elevation difference (Δh) of incline surface is less than 4m; linear array with unequal sensitivity is more favorable for suppression of surface wave having lower apparent velocity; areal pattern can suppress surface wave with any propagation direction and parallelogram's pattern is superior to rectangular pattern, which the former has more broad suppressed band and severe amplitude suppression; comparison of array characters between the impulse and simple harmonic wave resulted in both having consistent passband width but the former having non-periodic suppression band, which its amplitude oscillates on $1/n$.

Key words: complicated surface, receiver-array, shot-receiver-array, surface wave

Wang Yonggang, College of Geo-Resource and Information, China University of Petroleum, Dongying City, Shandong Province, 257061, China

AVO analysis for P-SV wave. Sun Pengyuan, Sun Jianguo and Lu Xiuli. OGP, 2003, 38(2): 131~135

Based on approximation of weak reflectivity contrast presented by Aki & Richards, the paper presented a new approximate formula of reflectivity after Taylor expansion of angle terms (incident and transmission) in reflectivity formula of P-SV wave described by Zoeppritz equation and after keeping second order terms related to density and velocity. The quantitative calculation results for 4 three-layered oil-bearing sand models showed that the approximate formula can better approach the precise solution of Zoeppritz equation within 40°, and has better effect than the Aki's, so that is suitable for AVO parameter inversion of long-offset data and theoretical study. Meanwhile, the process of using the approximate formula for lithologic parameter inversion has been deeply discussed from three aspects separately: converted wave reflectivity in different representative forms, AVO weighted stack method for P-SV converted wave and AVO simultaneous inversion of PP wave and P-SV
wave.

Key words: P-SV converted wave, approximation of reflectivity, AVO analysis, weighted stack

Sun Pengyuan, Geo-Exploration Science and Technology Institute, Jilin University, Changchun City, Jilin Province, 130026, China

A study on noise-suppression method in f-x domain. Kang Ye, Yu Chengye, Jia Wo, Wang Chunmei and Chen Ying. OGP, 2003, 38(2): 136~138

The paper proposed a pseudo-linear transform method that can transform seismic data in pseudo-linear fashion, and the predicted noise-suppression in f-x domain can be carried out on that basis. The concrete steps are follows: ① using orthonormal polynomial approximation and maximum similar coefficient criterion to calculate correlation factors that describe the trend of seismic events; ② using correlation factors to make pseudo-linear transform of seismic data in space, to carry out singular filtering of transformed seismic data and to predict the useful signal in f-x domain; ③ inverse-transform of predicted results. The theoretical and real data tests show that the noise-suppression method presented by the paper has advantages of strong noise-suppression ability, good amplitude fidelity and non-destructive vertical resolution, that is suitable for data processing in complicated region.

Key words: orthonormal polynomial approximation, linear transform, noise-suppression in f-x domain

Kang Ye, Institute of Exploration & Development, Daqing Oilfield Ltd., Daqing City, Heilongjiang Province, 163712, China

CFP method for velocity model inversion. Wang Chengxiang, Zhang Guanquan, Liu Chaoying, Zhao Bo and Zhang Wensheng. OGP, 2003, 38(2): 139~146

In face of the problem of building prestack depth migration velocity model, the paper deeply studied two methods for inversion of operator and velocity model in CFP half migration domain, that is synchronous inversion and asynchronous inversion. The former adjusts DTS response to align gather's event and to position zero timing line by changing velocity model. Each change of velocity model is followed by calculating focusing operator, CFP gather and DTS response and then using DTS response to calculate corrections of velocity model.

The method mainly uses isochronal principle, in which the modification of velocity model and the picking up DTS gather are closely related together. The method is straightforward and reliable. The main efforts are in picking up DTS response. The asynchronous inversion of operator and velocity model is iterative calculation of correct focusing operator first according to the principle of error symmetry, then inversion of velocity model is proceeded on the basis of operator separately, that bears no relation to picking up DTS response. The method got velocity model indirectly but greatly reduced the work effort of picking up.

In comparison with velocity analyzing method in an ordinary migration domain, the analysis in CFP half migration domain can be carried out at single geometric point on reflection interface and no windowed re-migration is needed, which greatly reduced computational effort; furthermore, there is no assumption of short offset or small dip that often exists in ordinary migration methods, that is suitable for analysis of migration velocity in complicated subsurface medium. The test results with synthetic and real data show that the method is feasible.

Key words: CFP, focusing operator, velocity model, inversion

Wang Chengxiang, GRI, BGP, Zhuozhou City, Hebei Province, 072750, China

A new method for calculation of elastic wave impedance. Ni Yi. *OGP*, 2003, 38(2): 147~150, 155

Elastic wave impedance technique is a method combining ordinary acoustic wave impedance inversion with AVO inversion, which can use seismic angular stack data in far-offset for inversion of wave impedance. Analyzing presently proposed several calculation tools of elastic wave impedance, the paper presented a modified method that combined with variated rule of adjacent velocity and density and with norm-dynamic-adjuctable etastic wave impedance calculation and illustrated the effectiveness of the method by calculation of models with typical lithologic parameters.
Key words: elastic wave impedance, Zoeppeitz equation, approximation of reflectivity in two-terms

Ni Yi, GRI, BGP, Zhuozhou City, Hebei Province, 072750, China

Comparison between normal moveout (NMO) methods for long-offset seismic data. Xue Gang, Wang Liangshu and Hu Zhongping. *OGP*, 2003, 38(2): 151~155

Normal Moveout (NMO) is one of key steps in seismic data processing, its precision has direct impact on whether the interference wave can be effectively suppressed by horizontal stacking. NMO is also a tool used for velocity analysis. Ordinary NMO processing uses Dix hyperbolic formula to align event under two preconditions: ① it's in isotropic layered medium; ② it's for middle-or near-offset receiver spread. But the long-offset receiver spread usually is adopted when explored geological targets is beneath a high-velocity stratum, so that the useful reflection beneath the high-velocity stratum can be received. Under the circumstances, using Dix formula for NMO correction of long-offset data can bring large errors, so higher-order polynomial fitting must be adopted. The paper analyzed different NMO methods for long-offset seismic data by forward calculating horizontal layered medium model, considering that there is no such thing for NMO correction of long-offset seismic data as that the higher the used order in polynomial fitting is, the better the precision of NMO correction is and that shifted hyperbola is not optimum everywhere. In a condition of without considering influence of anisotropic medium temporarily, the coefficient of high-order terms in polynomial is key factor having impact on NMO correction of long-offset seismic data, determining what NMO method should be used in practical processing of long-offset seismic data.
Key words: normal moveout correction, long-offset, Dix formula, high-order fitting, comparison between methods

Xue Gang, Department of Earth Science, Nanjing University, Nanjing City, Jiangsu Province, 210093, China

Common reflection surface stack method based on multi-level optimization of parameters and its application. Li Zhenchun, Yao Yunxia, Ma Zaitian and Wang Huazhong. *OGP*, 2003, 38(2): 156~161

Taking computational efficiency and imaging accuracy into consideration, we put forward the common reflection surface (CRS) stack method of multi-level optimization of parameters based on the idea of Hurbral's CRS stack. CRS stack is a seismic imaging method that does not depend on a macro

velocity model and only need to know near-surface velocity and relies on three wavefield parameters. It not only improves the quality of simulated zero-offset section and S/N ratio in deeper layers but also provides important seismic three-parameters section which can be used for inversion of a macro velocity model. The effectiveness and practicability of the method is proved by applying it to depression model, Marmousi model and real seismic data in Shengli Oilfield.

Key words: CRS stack, zero-offset simulation, S/N ratio in deeper layer, seismic three-parameters, multi-level optimization

Li Zhenchun, Collage of Geo-Resource & Information, China University of Petroleum, Dongying City, Shandong Province, 257061, China

A method for automatic recognition of high-resolution sequence-stratigraphy and its realization on computer. Wu Yijie, Gao Dequn, Xu Jiangqiao, Wang Yajun and Fan Tailiang. *OGP*, 2003, 38(2): 162~167

Recognition of short base level cycle is key to divide high-resolution sequence-stratigraphy; therefore, adopting quantitative method to study the change of base level cycle has very important meaning. Starting from calculating the sand-to-shale ratio based on logging data and through analyzing the density of seismic reflectivity, cycle change of synthetic seismic amplitude and of seismic time-frequency, the paper presented a method for synthetic recognition of base level cycle and automatic division of high-resolution sequence-stratigraphy. The application of real data proved the correctness of the method, which a new method for quantitative study of sequence-stratigraphy has been provided.

Key words: base level cycle, quantitative method, sand-to-shale ratio, reflectivity density

Wu Yijie, West end of Liuyin Road, Donglai Avenue, Longkou City, Shandong Province, 265701, China

Common action of aligned fracture and interface on elastic wave. Zhang Guangying and Zeng Xinwu. *OGP*, 2003, 38(2): 168~172

The paper simulated the propagation of elastic wave in a medium with horizontal interface by pseudo-spectral method (PSM). The medium consists of two parts: one part is rock without frac-

ture, the other part is rock with fracture aligned along fixed direction. The paper mainly simulated and analyzed the common action of heterogeneous interface of medium and aligned direction of fracture on elastic wave. The results showed that the different positional relations between aligned direction of fracture and interface have different effects of interface on elastic wave.

Key words: pseudo-spectral method, aligned fracture, interface, anisotropy, dispersion

Zhang Guangying, College of Science, National University of Defense Technology, Changsha City, Hunan Province, 410073, China

Meander channel sandstone reservoir pattern on slope belt and its description method: taking Laohekou oilfield for example. Wei Hongmei, Dong Chenqiang and Zhang Mingzhen. *OGP*, 2003, 38(2): 173~177

The thin sand reservoir of fluvial facies in Guantao formation is wide spread in Shengli exploration area. Three large oilfields having hundreds million tons reserve: Gudong, Gudau and Chengdao oilfield have been discovered in the offshore area of Jiyang Depression, which are typical shallow oil-rich accumulation units in Shengli exploration area. The practice of exploration shows a large drape-structural belt is main oil-accumulation area in Guantao formation, which guided exploration in the past. However, lithologic reservoirs in Guantao formation have been found on slope belt and recession of structure, such as Laohekou and Feiyantan oilfields along with development of exploration, which opened a new field for exploration of reservoir in Guantao Formation. Through analysis of exploration and development cases in Laohekou oilfield, there is new knowledge of shallow oil and gas migration and accumulation, building up channel sandstone reservoir pattern on slope belt in a condition of that big oil-source fault is absent, so that the exploration field of channel sandstone reservoir has been greatly enlarged; meanwhile, a set of recognition methods of channel sand body and its description method based on 3-D visualization has been explored and a useful study of method for oil-bearing prediction in channel sand body bas been carried out, improving successful rate of exploration.

Key words: up section of Guantao formation, meander channel, reservoir pattern, 3-D visualization,

absorption coefficient, instantaneous frequency

Wei Hongmei, GRI, Shengli Oilfield, Dongying City, Shandong Province, 257100, China

Application of geophysical and geochemical technique in buried-hill exploration: taking Che-gu 20 buried-hill for example. Shi Haoguo, Wang Jun and Sun Baojing. *OGP*, 2003, 38(2): 178~181

The buried-hill reservoirs are gradually important exploration targets, which are difficult to achieve good exploration results merely relying on single exploration technique because of its deep burial depth and complex structure. Taking the exploration of Che-gu 20 buried-hill reservoir for example, the paper analyzed the role that geophysical and geochemical exploration played in buried-hill exploration and effectively guided the planning of 3-D seismic exploration. Using 3-D seismic data and prestack depth migration section, the structural configuration of Che-gu 20 buried-hill has been correctly determined, which promoted the exploration and the development of buried-hill and achieved a good result.

Key words: buried-hill, gravity, geophysical exploration, geochemical exploration, prestack depth migration

Shi Haoguo, Department of Geo-Science, Jianghan Petroleum Institute, Jingzhou City, Hubei Province, 434023, China

Using seismic attributions for quadric programming inversion of porosity parameter. Li Peiming and Song Weiqi. *OGP*, 2003, 38(2): 182~184, 193

On the basis of detection, combination and optimization of seismic attributions and under the constraint of logging porosity data, the paper studied using seismic attributions for inversion of porosity parameters, in which quadric program inversion is adopted, that is, on the basis of detecting seismic attribution, the objective function of seismic attribution and porosity of some borehole is built up, the inversion calculation is carried out by taking the relation between seismic attribution and porosity of other borehole as a constrained condition. We calculated inversion for two boreholes and proved the results by extrapolating to second bolehole on the basis of inversive result of first borehole, the extrapolated inversive result of second borehole is compared with the calculated results for same borehole, and then inverse process as above-mentioned from second to first borehole is carried out. The comparison with logging data and the analysis of real data inversion results showed that the method is feasible and the results are correct.

Key words: seismic attribution, porosity, quadric programming arithmetic design, numeric calculation

Li Peiming, No. 210 Beiyi Road, Dongying City, Shandong Province, 257000, China.

Application of interpretation technique in structural-lithologic composite reservoir and its effects in Yingtai area. Sun Yan, Li Ming, Zhao Yimin, Zhao, Zhanyin, Ma Xinchang and Zhang Lixin. *OGP*, 2003, 38(2): 185~189

Yingtai area is one of the areas in the east of China where the exploration has prominent effect. The area has good stratigraphic-physic condition, high production capacity. The influence of throw, extension of fault and thickness of sand body on reservoir are obvious. Oil-gas accumulation mainly are concentrated into structural trap with low relief. The reservoirs mainly are structural-lithologic composite reservoirs. According to the petroleum-geologic characters of the region and fully using 3-D seismic data, the paper uses 3-D visualization interpretation technique, coherent body and stratigraphic dip detection technique, reservoir prediction technique and multi-contribution model-constrained inversion for interpretation of main targets and appreciation of traps. The applied techniques are practical and effective after drilling examination, having generalized value.

Key words: structural-lithologic composite reservoir, low relief, small fault, thin sand, interpretation

Sun Yan, Department of Exploration, Jilin Oilfield Sub-Company, Songyuan City, Jilin Province, 138001, China

Characters of reverse tectonics and its forming mechanism in late of fault depression in Songliao basin. Fang Limin, Li Yuxi, Yin Jinyin and Chen Junliang. *OGP*, 2003, 38(2): 190~193

Through interpretation and analysis of recent seismic exploration data, the reverse tectonics styles in the late of fault depression in Songliao basin can be divided into three kinds: the reverse tectonics, the fault-reverse tectonics and the lift-

decline tectonics. The reverse tectonics activity in the late of fault depression had big influence on Xujiaveizi fault depression and Lisu fault depression, which formed reverse deforming structures such as anticline and reverse fault; but its influence on other fault depression mainly resulted in lift-decline tectonics. Adopting the principle of unchanged layer length and areal conservation, the 2-D balanced restoration can be done for interpretation sections, after that, we considered that the reverse stage began the late of Kimaeridgian stage and ended at the late Ryazanian stage, resulted in making an end of fault depression in Songliao basin and in denudation because of uplift of the region. The analysis of regional tectonic stress field and of characters of earth evolution, the paper discussed the forming mechanism of inversed structure at the late of fault-depression and discovered that the maximum stress direction of regional tectonic stress field resulted in reverse deformation was NEE—SWW, and the slowed and declined uplift of earth mantle resulted in squeeze stress in fragile crust, forming related shrinking reverse tectonics.

Key words: Songliao basin, fault depression, reverse, tectonic stress field

Fang Liming, Institute of Exploration and Development, Daqing Oilfield, Daqing City, Heilongjiang Province, 163453, China

Character and distribution of seismic facies favorable for oil/gas accumulation in Middle-Upper Ordovician, Tazhong area. Li Hongge and Han Yuchun. OGP, 2003, 38(2): 194～198

Middle-Upper Ordovician is one of the main target for oil/gas exploration in Tazhong area. Through interpreting a large amount of 2-D and 3-D seismic data, the authors discovered that a special seismic facies widely distributed in Middle-Upper Ordovician, Tazhong area. The facies has large depositional thickness, showing colina shape, desultory interior reflections and extension along major structural alignment on seismic section. Combining with bore-hole information, the authors considered that the facies is composed of carbonate reef and beach facies developed in different stages on carbonate platform, which mainly distributes in margin of the platform, facing on sea, or relatively convex parts in palaeo-geomorphology inside platform. The practice of exploration and development proved that it is favorable zone for oil/gas accumu-

lation, so we map their distribution, from which we can see that they mainly distrbuted on Tazhong fault belt, well Tazhong No. 1 structural belt and Tanan structural belt. The study has important guide meaning for oil/gas exploration in Tazhong area.

Key words: Tazhong area, Middle-Upper Ordovician, seismic facies, reef, beach facies

Li Hongge, Geology Center, GRI, BGP, Zhuozhou City, Hebei Province, 072751, China

Model-constrained 3-D first break refraction static corrections. Li Peiming, Li Zhenhua, Zu Yunfei and Hou Xichang. OGP, 2003, 38(2): 199～202, 212

In face of difficult static problem encountered during exploration in complicated mountainous area of the West of China, the paper presented a reasonable and effective model-constrained 3-D first beak refraction static correction. Fully using a priori surface information from surface survey and combining with first break of refraction in production shot, the paper calculates more precious velocity and thickness of near-surface layers vertically and laterally, builds up regional reasonable surface model in the area and finally calculates static corrections with high quality. The paper analyzed the technical difficulty of 3-D static correction in mountainous area, summarized the experiences solved this kind of difficulties before and presented the adopted technical measures and strategies in face of complicated mountainous area. The technique better solved the difficult problem of 3-D static correction in many mountainous area such as Gumudi, Huoerguoshi, Huoyanshan and Dina etc.

Key words: static correction, surface survey, 3-D model building, first break refraction

Li Peiming, Department of Exploration, BGP, Zhuozhou City, Hebei Province, 072750, China

Study on processing method for seismic data with low S/N ratio in Tarim basin. Hu Pengfei, Kang Yanfang, Li Gang, Wang Kai and Li Hong. OGP, 2003, 38(2): 203～207

All difficult factors, such as complicated surface and subsurface structure, complicated surface static correction and wavefield, difficulty of detecting useful signal and poor imaging quality resulted from complicated velocity field, etc., bring a very difficulty to the seismic data processing in Bachu area, Tarim basin. In face of the characters of low

S/N ratio data in this region, the processing procedure of seismic data with low S/N ratio built up in WGC batch software platform is difficult to meet the needs of exploration and development. So, in 1999 a set of perfect precessing methods for seismic data with low S/N ratio has been developed through the full use of flexible and convenient interactive tools of FOCUS processing software and management of data base in the platform of imported FOCUS interactive processing software, and achieved good results in application of real data processing. The paper briefly introduced the concrete processing techniques adopted in solving seismic data with low S/N ratio and the achieved preliminary results in order to make the processing level of seismic data with low S/N ratio in a condition of complicated surface get raise together.

Hu Pengfei, GRI, Institute of Designing and Programming, Northwest Bureau of Petroleum, Urumqi City, Xinjiang Uygur Autonomous Region, 830011, China

High-resolution inversion and its application in nuclear magnetic resonance (NMR) logging data processing. Weng Aihua, Li Zhoubo, Lu Jingan and Mo Xiuwen. *OGP*, 2003, 38(2): 208~212

The paper mainly discussed the applied effects of high-resolution inversion of relaxation spectrum in nuclear magnetic resonance (NMR) logging data. First, the paper introduced the principle of the method, discussed the influence of sample interval of relaxation spectrum in the method and compared the method's result with the result from core mercury injection. Then, the high-resolution inversion is applied to real NMR logging data which come from two layers containing high and low shale content separately in a same borehole. It can be found from comparison with ordinary inversion result of relaxation spectrum that the high-resolution inversion of relaxation spectrum can give more detail of pure fluid relaxation distribution behind the echo trains, resulted in true high-resolution relaxation spectrum.

Weng Aihua, Department of Applied Geophysics, Jilin University, Changchun City, Jilin Province, 130026, China

2-D inversion of magnetotelluric (MT) multi-parameters with topography using fast simulated annealing. Yang Hui, Wang Yongtao, Dai Shikun and Zhang Linbin. *OGP*, 2003, 38(2): 213~217

Fast simulated annealing arithmetic is adopted to realize 2-D non-linear constrained inversion of MT data with uneven topography. Theoretic model test showed the correctness and effectiveness of the method. The inversion has been performed for real data on line CEMP 268 in Yiqikelike region in a constraint of a priori knowledge such as borehole and seismic data etc., supplementing the shortage of drilling and seismic data and providing the thichness and distribution of Mesozoic layer—important source rock and reservoir of the region, which provided an important basic data for geologist.

Yang Hui, CNPC Key Geophysical Laboratory, China University of Petroleum, Beijing City, 100083, China