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Using OBC dual receiver to suppress reverberation of water column.Quan Haiyan and Han Liqiang.*OGP*,2005,40(1):7~12

OBC dual receiver is a new developed exploration technique in the late eighties of last century, which is mainly used to suppress "water column reverberation" interference appeared between sea bottom and sea level that resulted in effectively improving S/N ratio of seismic data. The key of the method is to lower the OBC at sea bottom or a certain depth level under the sea, then the seismic data are simultaneously recorded by hydrophone and vertical velocity geophone at same survey point. Because the both geophones have opposite response to water column reverberation, the seismic data received by two kinds of geophone can be separately processed, the output results then are added and finally the records that both strengthen useful signal and eliminate water column reverberation can be reached. The technique has already become the criterion of OBC exploration. The technique has been imported in China in the late nineties but good results have not been achieved because of the limitation of processing techniques. On the basis of deeply studying the technique and in combining with practical data, the paper put forward a set of data processing ideas, in which the match of frequency in dual receiver records is emphasized. The good results can be gained only in that way.

Key words : ocean bottom cable (OBC),water column reverberation, wave field separation, frequency match, amplitude match

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Exploration of over-thrust structure in Horgos complex mountains. Lü Fuqing, Su Weimin, Qin Xin, Huang Yongping and Luo Ming.*OGP*,2005,40(1):13~17

Horgos over-thrust structural belt is in piedmont of north Tianshan Mountain, south margin of Junggar basin. Although after many years' seismic exploration, the little effects are produced because of very complex seismic geologic conditions in that region. In new round of tackling the key problems of seismic exploration developed in 2003 in Horgos region, according to the characters of complex near surface and underground structures, we used high precision satellite photo aided design of acquisition scheme; adopted a new exploration ideas such as flexible and variable geometry, fold, shooting pattern, shooting factor and adaptable static corrections methods; drew up technical operation scheme that proceeded from the practical situation and took acquiring good seismic data as an object, which resulted in good effects and mainly showed as follows : strong reflected energy and high S/N ratio at the targets; distinguished fault characters and over-thrust plane; the blind zone in north flank of Hordos structure on the former seismic sections disappeared and clear relation between shallow and deep local structures appeared.

Key words : south margin of Junggar basin, near surface model, over-thrust structural belt, geometry changed high precision satellite photo

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3D,3C VSP data processing methods and effects. Yan Yousheng,Yi Mingli,Wei Xin and Xu Zengkui.*OGP*,2005,40(1):18~24

3D,3C VSP data processing is a systematic engineering. Because of speciality of geometry, the VSP data processing can neither use the ordinary non zero offset multi component VSP data processing methods, nor use the current land seismic multi component data processing methods. In that reason, faced with the 3D,3C VSP data characteristics, the paper studied the following aspects : 3D VSP velocity analysis, wave field separation,3D depth imaging of P wave and PS converted wave and probed a set of processing methods. The velocity data volume has been gained after the VSP data processing in MB 2003 well site; the up-going P wave and PS converted wave have been successfully separated by 3C data processing and joint wave field separation based on Radon transform and polarization analysis; imaging processing of P wave and PS converted wave in depth domain have been implemented and both imaging data volumes have been obtained separately according to the results of velocity inversion, which have good correlation and are of benefit to data interpretation, among which the imaging of PS converted wave showed higher resolution and S/N ratio, which has good applied prospect.

Key words : 3D VSP, velocity inversion, wave field separation, multi component data processing, imaging in depth domain

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Influence of aperture angle on precision of 3D wave field extrapolation. Di Bangrang, Gu Chong, Ni Chengzhou and Gu Peicheng. *OGP*, 2005,40(1):25~30

The selection of aperture angle is most direct and key factor for affecting the precision and efficiency of 3D seismic wave field extrapolation. Using Rayleigh integration formula in space frequency domain, the paper deduced theoretically the precision of wave field extrapolation for both single pole and dipole sources, then deduced the analytic formula of errors. The analysis showed that the errors of amplitude mainly depend on aperture angle θ , the other parameters such as frequency f, velocity v and normal distance z only have limited influence on errors of phase. Numeric modeling by gritting the extrapolated reference plane and replacing integration with stack of wave function at discrete grit, the paper tested the correctness of the analytic formula. Finally, the paper presented the selected criterion of optimal aperture angle with hi-fi 3D wave field extrapolation (precision of amplitude $\geq 80\%$) : the angle θ is selected as great than 60° for single pole source and the angle θ is selected as great than and equal to 55° for dipole source. This criterion can be used for theoretic study but it must do concrete analysis and synthetic balance when using it to solve the practical problems.

Key words : wave field extrapolation, aperture angle, single pole source, dipole source, Reyleigh integral formula, spiral hologram

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Static corrections by continuation of wave equation inversion in complex near surface. Wang Shoudong.*OGP*,2005,40(1):31~34

Static correction is one of key issues that the seismic exploration faced with in complex near surface , that constrained the quality of data processing to a considerable degree. On the basis of knowing near surface velocity model, the paper studied the method of static corrections by using wave equation inversion, that is, summing static corrections up as the inversion of wave equation boundary values (also called as inversion of unknown boundary values) In other words ,the static corrections in complex near surface can be realized by inversion of wave equation boundary values. The paper give numeric solved method in view of the characters of inversion. The static corrections method is characterized by adaptation to complex surface relief and rapid near surface velocity change and can fully consider the transmission, dispersion and reflection appeared when wave field goes through the near surface, which made the continued wave field have higher precision. The numeric modeling results proved the effectiveness of the method.

Key words : static corrections, inversion, inversion problem, wave field continuation

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Studying uncertainty of deep seismic velocity analysis. Jiang Xianyong, Wang Xiwen, Qin Guangsheng and Liu Lianhai. *OGP*, 2005, 40(1):35~41

The precision of velocity is directly relative to the quality of stack and migration of seismic data in 3D deep seismic exploration. Faced with the characteristics of weak reflected energy, poor S/N ratio, lower resolution and smeared base reflections in deep seismic data, the paper discussed the uncertain factors in analysis of deep seismic velocity according to basic theory of seismic exploration. It is considered that it must consider the isotropic medium as VTI medium in a deep condition and the time distance curves at larger offsets are no longer the hyperbolic curves but high order curves contrarily. Therefore, the common used velocity analysis method is no longer used and new velocity analysis method is needed when carrying out velocity analysis. The paper recommended two methods for velocity analysis in VTI medium : non hyperbolic P wave velocity analysis and template method, which achieved practical and stable effects.

Key words : deep seismic data, uncertainty, non hyperbolic curve, VTI medium, template, time distance curve

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Using 3D beam forming filtering method to eliminate coherent noise. Hong Fei, Hu Tianyue and Wang Runqiu.*OGP*,2005,40(1):42~47

The coherent noise is main obstacle for improving S/N ratio, correctly conducting the velocity analysis and migration in 3D seismic exploration of complex areas. The current used coherent noise eliminated method is also not satisfactory, for that reason, the paper tried to use 3D beam forming filtering method to eliminate the coherent noise in 3D seismic data. Considering the complicated 3D geometry, we use two key steps in design of 3D beam forming filtering method :

partitioning the seismic data according to azimuth angle and simplifying the 3D time distance relationship to 2D time distance relationship made the high cost and instability be avoided;

introducing dynamic balance bin to avoid the insufficiency of seismic channels in some azimuth partitioned areas, so that guaranteed the stability and high resolution of results. The processing results of synthetic and practical data showed that the 3D beam forming filtering method presented by the paper can effectively eliminate a variety of coherent noise.

Key words : 3D seismic exploration, noise elimination, beam forming filtering, coherent noise, multiple

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Study on elastic constructive relationship and angle dispersion of orthogonal medium. Shi Yaliu, Ning Shunian and Xiao Jianhua.*OGP*,2005,40(1):48~51

The paper first discussed the anisotropic elastic constructive relationship of double layered EDA fractured medium and deduced the solved formula with equivalent elastic constants and angle dispersion formula in orthogonal EDA medium on the basis of Postma method; then, briefly introduced forward and inversive pseudo spectrum algorithm; finally, conducted numeric modeling calculation for wave velocity and travel time by using angle dispersion formula and pseudo spectrum method separately and gained consistent results, that is , the S-wave splitting phenomenon in orthogonal medium is more obvious than in other medium.

Key words : EDA medium, anisotropy, constructive relationship, angle dispersion, pseudo spectrum

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Interpretation case : a being development proved concealed oil/gas reservoir. Ling Yun Research Group.*OGP*,2005,40(1):52~57

Looking for concealed oil/gas reservoir is becoming one of hot points of most interest by the people. A year ago, the author used the technical idea forming the mode of "seismic analysis by reservoir evolution" to deeply study the development case of concealed oil/gas reservoir in a oilfield of northern Tarim basin. The set of technical ideas is : first, adopting the processing of improving resolution based on amplitude and waveform preservation ; then, picking up seismic attributes along referential markers on a basis of conducting well information labeling for referential markers ; finally, the thin reservoir the thickness is less than 1/4 wavelength being identified by spatial changes of seismic attributes. It is proved after over one year's development of the concealed oil/gas reservoir that the currently developed areas coincided similarly with distributed areas of predicted seismic amplitude anomaly provided before, which proved the author summed up interpretation method of "seismic analysis by reservoir evolution" has broad application prospect for exploration of concealed oil/gas reservoir.

Key words : concealed oil/gas reservoir, seismic exploration, resolution, seismic attributes,1/4 wavelength

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Study and application of spatial propagation characteristics of SWD seismic wave field. Luo Bin and Wang BaoBin.*OGP*,2005,40(1):58~64, 70

Seismic While Drilling(SWD) is a new technique developed in the 90s of the last century, which taken vibration of drill bit in drilling process as a seismic source to conduct seismic survey that can make real time prediction of the detail of formation structure ahead of drill bit and reduce the risk of drilling. Starting from the theory and real data processing, the paper systematically studied the propagation characteristics of wavefields of direct wave, reflected wave and other major interference waves; discussed the separation and attenuation methods of interference waves according to difference in 3D spatial propagation characteristics of a variety of wavefields; the noise eliminated processing of SWD data gained a ideal effects. The studied results of the paper have guiding meaning to SWD exploration.

Key words : seismic while drilling, drill bit, pilot signal, seismic wave field, noise attenuation Luo Bin, GRI, BGP, Zhuozhou City, Hebei Province,072751,China

Dynamic probabilistic neural network and predicting probabilistic distribution of oil/gas. Xu Wanglin, Pang Xiongqi, Lü Shuying and Michael R Berthold.*OGP*,2005,40(1):65~70

Traditional probabilistic neural network (PNN) adopted localized and Gauss style's operational function of Radial Basis Function that has better categorizing ability but exists the following limitations : the number of neural cells of model increased if studying samples increased, which leads operational matrix to increase and makes it almost lose the ability of large data volume processing; The weight from model to summation is fixed as constant that needs the number of all kinds of samples in studying sets to be equal, which affects the ability of receiving real data.In this reason, the paper introduced the Dynamic Probabilistic Neural Network (DPNN), which is different from traditional PNN in structure as follows : using unequal weight to connect the model and summation, the weight is determined by probabilistic distribution of studying sample the number of different kinds of samples in studying sample sets (the number of neural sets: cells lain in model for different kinds) can be unequal. The paper also introduced DPNN algorithm. The theoretic data tests showed the DPNN structure is characterized by rapid dynamic adjustment and studying convergence as well as strong ability of identifying categories. The 22 attributes of real data in G oilfield are selected as input vectors of network, the oil bearing probabilistic distribution map is obtained by using categorized identification, which can provide the basis of predicting prospective oil/gas traps and distributing rule of oil/water.

Key words : dynamic probabilistic neural network, seismic attributes, pattern recognition Xu Wanglin, Basin and Reservoir Research Center, Petroleum University, Beijing City, 102249, China

Non stationary random medium model. Xi Xian and Yao Yao.OGP,2005,40(1):71~75

The paper first discussed the conception of stationary random medium model and pointed out that the stationary random medium model consists of non homogeneous parts of large and small scale. Large scaled non homogeneous part describes the average nature of medium, i.e. geological model in traditional meaning; small scaled non homogeneous medium means the random disturbance added to geologic model that usually presented the non homogeneity of medium in a small scale by a spatial random process that mean is equal to zero (description by a spatially correlated function), therefore, only using a small amount of statistics (spatially self correlated function, correlation length, mean and standard deviation etc.) can describe the disturbance of elastic parameters of medium in small scaled space but can't flexibly describe real media characterized by non stationary change. The paper presented the conception of non stationary random medium model and considered statistic values of medium disturbance (such as autocorrelation function, mean and standard deviation etc.) slowly change with spatial coordinate in large scale, which is essential different from the disturbance of medium in stationary random medium model. According to the theory of spectrum dissolution of random process, the paper put forward the conception of local autocorrelation function and showed the random disturbance of medium by a spatial random process that the mean is zero, autocorrelation function and standard deviation slowly changes with spatial coordinate in large scale and the constructing method of stationary random medium model is generalized to construct non stationary random medium model as well as the algorithm of constructing non stationary random medium model is gained. The modeling results showed that the non stationary random medium model presented by the paper can more flexibly and accurately describe all kinds of complex and non homogeneous medium models, so it has stronger adaptability.

Key words : random medium model, spectrum dissolution, local autocorrelation function, non stationary

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Seismic numeric modeling in large scale rapid changed velocity medium and using finite integral transform for migration imaging. Sun Jianguo.*OGP*,2005,40(1):76~82

The paper introduced the general principles using finite integral transform to represent function; taken the 2D scalar wave equation (acoustic wave equation) as an example, the paper sums up the migration imaging method in hybrid domain presented by former Soviet Union scholar Mr. Mikhailenko, uses finite difference in time and space domain and Fourier transform in time as well as finite difference approximation in space of the 2D scalar wave equation to get the numeric solution of wave field; on that basis, the seismic numeric modeling based on finite integral transform and basic equations of improved split step Fourier migration scheme are also deduced, after discretization in time and space terms of basic equations by finite difference or at least taking finite or infinite integral transform for either of terms, the calculating process similar to classic scheme can be used to solve the infinite set of equations constructed from basic equations and numeric modeling of wave field is finished, the calculation effort can be greatly reduced in comparison with classic equations; taken the 2D split step Fourier migration as an example in the paper, it summed up the basic ideas of seismic migration based on finite integral transform : implementing phase shift for homogeneous background velocity model in transform domain and of non homogeneous medium in space domain; the paper also discussed the numeric calculation and finite process of source, calculation efficiency and correlation with other numeric modeling of seismic wave field and migration imaging methods, which considered that the finite integral transform method can infinitely expand the calculation interval and fulfill numeric modeling of seismic wave field and migration imaging under any velocity structures. The numeric calculation results showed that the finite integral transform scheme can give satisfactory results and this numeric modeling and migration imaging method can be expected to provide strong means for future studying large scale seismic wave transmission and imaging theory and for future production.

Key words : large scale, rapid velocity change, finite integral transform, numeric modeling of seismic wave field and migration imaging

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Inversion of lithologic parameters driven by neural network data in depth domain. Cui Fenglin and Zhang Xiangjun.*OGP*,2005,40(1):83~86, 112

In view of the issue of seismic data inversion in depth domain, the paper presented the method for inversion of lithologic parameters driven by neural network. The inversion method is non linear and is driven by data as well as don't need any determinate operator, among which the data driven scheme is finished by structural risk minimized neural network. During the operation of inversion, the logging data and seismic data are usually taken as training samples, among which the seismic data in uphole receiver are taken as input and logging data as output, the inversion mapping relation transformed from seismic data to logging data is obtained when network learning is finished and the gained data are used for lithologic interpretation. The paper showed the effectiveness of the method by theoretic models and inversion cases of lithologic parameters of seismic pre-stack depth migration data.

Key words : depth domain, neural network, data driven, inversion, minimum risk of structure Cui Fenglin, Geophysical Exploration Company, Daqing Oilfield, Daqing City, Heilongjiang Province,163357,China

Seismic stochastic inversion and its application in Wenchang 131 oil field. Yi Ping and Lin Guikang.*OGP*,2005,40(1):87~91

Seismic stochastic inversion technique is a such inversion method that combines the stochastic simulation theory with seismic inversion, which can effectively improve the vertical resolution of seismic data and fully consider the random characters of subsurface geology that made the inversion results more consistent with practical geological scenario. Taking the results of determinative seismic inversion as soft data and logging data as hard data, the paper uses collocated Cokriging sequential Gauss simulation technique to do inversion of physical changes of reservoir. The studied results of the case in Wenchang 131 oilfield showed that the seismic stochastic inversion has higher vertical resolution in comparison with the determinative seismic inversion based on model, it can fully use seismic data in geologic model building process of reservoir and easily gain good results.

Key words : seismic inversion, stochastic simulation, logging constrained inversion, integrative geologic model building of reservoir

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Application of sequential indicator simulation with a trend to predict thin bedded sandstone reservoir in Dongpu sag. Lei Li'an, Xu Meiru, Cao Xueliang and Lu Shuping. *OGP*, 2005, 40(1): 92~96

The modeling method of sequential indicator simulation with a trend is a stochastic simulation method based on geological statistics, its basic works are 3D fine seismic data interpretation and standardized processing of logging data. The key steps of implementing the method include forming lithological curves for a single well, building trend model, analyzing distribution rule of reservoir parameters in space and spatial correlation and assessing reliability of reservoir parameters model as well as optimizing it besides the following methods : detection of wavelet by logging constrained wave impedance inversion, fine labeling of the formation, building geological framework model and selecting the constrained parameters of wave impedance inversion etc. In comparison with the logging constrained wave impedance inversion, the method is characterized by not only greatly improving the vertical resolution and fine description of reservoir characters, but also the qualitative assessment of the non homogeneity and uncertainty of spatial distribution of reservoir parameters. The practical use of the method in QB block of Dongpu sag showed that the method clarified favorable distribution region of oil/gas bearing sandstone and spatially changing low of its thickness.

Key words : sequential indicator simulation with a trend, wave impedance inversion, s and stone, reservoir prediction, resolution of lithologic section, Dongpu sag

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Application of 3C VSP uphole survey technique in near surface survey. Yang Haishen, He Qinghua, Liang Xiuwen, Dang Xiaochun and Kang Dahao.*OGP*,2005,40(1):97~102

Uphole survey technique is one of major tools of near surface survey, but the number of layout of uphole survey is constrained by the higher cost. The paper presented 3C VSP uphole survey technique, i.e. uphole survey pattern adopting shooting in surface and receiving by geophone in hole, the shot hole in seismic exploration is used as well for uphole surveying. The method not only reduced the cost of uphole survey, but also increased the density of distribution of uphole survey. The T0 time in top interface of high velocity can be used as control points of interpreted near surface structure if the low velocity layer of well for the uphole surveying is penetrated through, otherwise, the up-going wave information of VSP can be used to detect the depth and velocity data of beds below the depth of well.

Key words : 3 component(3C), uphole survey, VSP, acquisition method, fitting, interpretation, S-wave

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Application of high order statistics to identify weak seismic signal and "magnetic bright spot". Yang Yushan, Li Yuanyuan and Liu Tianyou.*OGP*,2005,40(1):103~107

The "magnetic bright spot" appeared in hydrocarbon penetrated alteration zone is a new developed direct hydrocarbon detector technology in recent years and along with this many new methods used for detection of "magnetic bright spot" appeared. The paper mainly discussed the method of high order statistics aimed at picking up "magnetic bright spot" The paper mainly studied the high order statistics related natures and proved theoretically that high order statistics not only totally suppressed the impact of Gauss color noises in signal, but also provided phase information the power spectrum haven't, which showed that the high order statistics is more superior to power spectrum method. The paper also analyzed the statistic characters of "magnetic bright spot" produced by hydrocarbon penetrated alteration zone and showed the feasibility using high order statistics for detection of "magnetic bright spot". Finally, the method is used to pick up "magnetic bright spot" from aeromagnetic data in Bayanhaot basin. The results showed the high order statistics method is similar to width amplitude character filtering method but has better results .The high order statistics method can find wide application in geophysical signal analysis.

Key words : magnetic bright spot, high order statistics, Bayanhaot basin, aeromagnetic survey with high precision

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New progress and application of integrative geophysical survey techniques. He Zhanxiang, Wang Yongtao, Liu Yunxiang and Sun Weibin.*OGP*,2005,40(1):108~112

In recent years, integrative geophysical techniques of gravity, magnetic survey and electric survey developed toward the direction of 3D high precision and high resolution survey and integrative survey, the former is basis and the latter is objective, both aspects have both connection and difference. So far as 3D gravity and magnetic survey is concerned, the data acquisition, topographic correction and 3D forward and inversion methods are gradually practical; in view of 3D electro magnetic survey, the data acquisition and processing can be easily fulfilled technically and there is a set of more feasible methods now, the current main issue is that the 3D forward and inversion methods haven't a more adaptive and rapid algorithm, meanwhile, the 3D visualization of electro magnetic data is proposed to adapt the platform used for visualization of seismic data. When expounding the development of integrative geophysical techniques of gravity, magnetic survey and electric survey, the paper emphasized the old integrative mode in the past that makes correlation and reference each other is no longer used, on the contrary, it must be a joint inversion based on 3D data, currently studied joint inversion methods include constrained extrapolation method, anomaly stripped method, sequential correction method and uniform correction method. **Key words** : 3D techniques, integrative geophysical survey, joint inversion, data acquisition, 3D

visualization

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Suggestion on oil/gas exploration in paleo buried hill of Taihangshan piedmont depression. Liang Shengzheng, Wang Changling, Dang Lingqun, Zuo YinQing and Li Xiaohong. *OGP*, 2005, 40(1): 113~118

Many years' prospecting practice showed that Jizhong depression. Jinan area and Tangvin fault depression of Taihangshan piedmont depression are complex oil/gas accumulational zone where the source rocks are in Palaeogene and Carboniferous Permian and main body of reservoirs are buried hill reservoirs taking the form of "source in young formation and reservoir in old formation" and "source both in young and in old formation and reservoir in old formation". The Jidong depression has been in the epoch of deep buried hill exploration in recent years. 10 paleo buried hills are discovered in the northeast of Jidong by using gravimetric, magnetic, electric and seismic exploration data and 5 buried hills have been drilled, among which 2 buried hills have gained industrial gas stream and 2 buried hills have obtained low productivity gas stream; Large scale buried hills of "source in young formation and reservoir in old formation"-Xinglonggongbei and Gu'an buried hills have been discovered separately in Baxian depression and LangGu depression. The paper expounded the size of gas reservoirs of Matou and Hancun buried hills that have gained low productivity gas stream and their source rocks mainly are Carboniferous Permian coal measures, put forward the geologic and geophysical bases why did these two large scale buried hills of "source in young formation and reservoir in old formation"-Xinglonggongbei and Gu'an buried hills exist and their oil bearing prospect and proposed corresponding suggestion on the oil/gas exploration issues how to further know and define above mentioned paleo buried hills. The authors considered that the region could become exploration battlefield achieved strategic breakthrough and surprised success.

Key words : Taihangshan piedmont depression, paleo buried hill, oil/gas exploration, integrative exploration

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Tendency of development of global oil geophysical exploration industry and techniques. Feng Lianyong, Niu Yan and Sun Mei.*OGP*,2005,40(1):119~122, 125

Development of global oil industry in recent years has brought shock to oil geophysical exploration industry, mainly resulted in supplying a surplus of geophysical exploration industry and fierce competition among geophysical exploration companies and made the geophysical exploration industry be at bottom of its life period; multi users mode met challenge in market strategy; global oil geophysical exploration market size increased slowly in recent years; oil company shifts risk on to geophysical exploration companies and the operational environment of geophysical exploration company is more difficult; the production ability of global oil geophysical exploration companies; Chinese company is a new force suddenly coming to fore and becomes a neglected force in international market. Looking forward to the future, the tendency of development of global geophysical exploration industry and techniques is as follows : major big geophysical exploration industry and annexation of companies are still continuing; investment size of multi users mode continuously reduces; the tendency of technical development of geophysical exploration is still stronger.

Key words: world oil, geophysical exploration, industry and technique, developed tendency Feng Lianyong, Petroleum University, Beijing City, 102200, China