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Spectral decomposition technology in oil and gas reservoir prediction

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Abstract: Since the seismic data is not high speeds, limited resolution, for not responding on some of the thin reservoir and the reservoir can not effectively predict earthquakes, so the researchers started use spectral analysis to study hydrocarbon detection and reservoir prediction. Spectral decomposition technique stems from the BP oil company to explain the new technology is based on the frequency domain reservoir, which uses short when the target window Fourier transform technique geological converted from the time domain to the frequency domain to identify, in order to better determine reservoir geometry, improved seismic resolution. This technology is widely pan used for characterization of laterally discontinuous geological anomaly, thin reservoir prediction structure and the judgment of sedimentary environment; we have made a good application in reservoir prediction of gas fields in the work of Affect.
Keywords: spectral decomposition; tuning frequency; tuning thickness; reservoir prediction.

INTRODUCTIONS

In reservoir prediction work, we used seismic amplitude class qualitative analysis of reservoir properties, the use of acoustic impedance, elastic impedance inversion quantitative reservoir characterization. However, due to seismic data frequency is not high, limited resolution, some thin reservoir and the earthquake did not respond to the reservoir can not be effectively predicted. So in the late 1980s with continuous spectrum analysis research methods and reservoir prediction hydrocarbon detection, when the study is seismic reflection horizons along a certain time window range extraction seismic attributes, qualitative spectral analysis; the 1990 first year frequency changes with time to determine the relationship between the deposition ring when the territory of frequency analysis method. However, these methods because of the Fourier influence transform window, limit their field of thin reservoir application [1].

From the BP oil company is a spectral decomposition technique to explain the new technology based on the frequency domain of the reservoir, which is the head Geological scale conversion from the time domain to the frequency domain to identify, or is converted into a single frequency of frequency four-dimensional data volume, to better determine the geometry of the reservoir, to improve earthquake Resolution, the technology is widely used in the characterization of laterally discontinuous Geological anomalies, thin reservoir layer structure prediction and judgment Shen Environment and other aspects of the product [1].

Spectral decomposition within a short time window by spectral decomposition Predicting reservoir study to show a thin layer of varying properties to explain the new technology surgery. Because it is better to solve the long-troubled oil Geologist's short window Fourier transform of the problem, by division. The resolution of the processed seismic data than conventional main earthquake Frequency can reach resolution. In addition, because the technology can Extraction of seismic data within the effective bandwidth of all discrete frequencies. The amplitude should be tuned to achieve an interactive, dynamic way research. Thin continuous change in vertical and horizontal direction, in determining the effective reservoir distribution layer, the effective thickness of reservoir computing has unique advantages Potential.

Principle of spectral decomposition techniques

Spectral decomposition is a three-dimensional seismic data and discrete Fu. When a new means of Fourier transform frequency conversion, its theoretical base, A thin layer of reflective base system can produce complex resonance reflection. Thin reflective layer in the frequency domain feature unique expression may indicate a time thick variation. Amplitude spectrum obtained by a thin layer of reflective tuning can be determined Relationship between acoustic properties of the individual strata constitute reflections between the amplitude spectrum by spectral notch curve to determine the thin stratum changes. Spectral notch curve and the local rock (such as local geology, fluid, heavy Changes integrated, etc.) related to [2]. Periodic amplitude spectrum notch the frequency value can be

determined layer thickness, local phase by phase spectrum the formation of lateral instability reflects discontinuity. Different frequencies the rate of formation of different sensitivity to different thickness, detect points cloth high-frequency range to give a thin layer of thin distinguished tuning response, thick layer of low frequency tuning response distinguished thick layer. Discrete frequency one correspondence with the thickness of time, the time of the thickness of discrete frequencies countdown namely $\Delta t = 1 / 2f$. TLC breakthrough detection limit $1 / 4\lambda$, and layer can be identified than $1 / 4\lambda$ thinner [3].

Spectral decomposition technique is the use of a thin layer of discrete frequency tuning body characteristic spectral changes and adopted by the Board to analyze complex formation retraction instability unit phase, identifying thin stratum lateral distribution. Range selection window is re-D seismic data object layer to the frequency spectrum amplitude windows and window-hour response time is a big difference Huge, large windows amplitude spectrum frequency response similar to wavelets Spectrum, can often cause white noise or flare phenomenon;-hour window when the frequency conversion geological body acts like a filter on the reflection wavelet, A longer white noise amplitude spectrum [4] (Figure 1). Hour window Spectral decomposition, you can reduce the formation of geological sampling randomness. Hour window three-dimensionally seismic data volume through spectral decomposition hour window tuning frequency domain three-dimensional volume, tuning a three-dimensional body usually consists of a thin layer interference stack wavelet cover and noise components. Suppose resonance along the leveled layer changes by for each frequency slice wavelet balanced, you can wave the white noise of the child, thereby eliminating the influence of the sub-waves. Within a frequency range, a relatively high confidence noise ratio to produce a clear image of a thin layer of tuning can ignore the noise dry interference. The amplitude and frequency can be tuned by the entire frequency range of Health Move reflected. Interpreters frequency analysis by interested slices, Tuning characteristics observed in the plane, identification of geological deposition process the structure and patterns to predict the transverse spatial geological bodies' variety.

A spectral decomposition technology in gas field

A relatively complete form field configuration for a low amplitude Trans turn anticline. Drilling reveal its main production layer H6 gas reservoir. Comprehensive analysis H6 gas reservoir is structurally controlled by a massive side, bottom water gas reservoir. H6 is displayed as a gas reservoir on well logging data low-speed, low-density, low resistivity gas reservoir, its top surface reflecting the positive polarity is a reflection intensity moderate trough seismic section. After detailed 3D seismic interpretation using seismic interpretation horizon was attribute analysis, seismic attribute analysis found that during pitch drilled Well A-3 wells not far from seismic attributes feature changes, see figure 2. This change reflects the seismic attributes of reservoir rock. Lateral variability or reservoirs of oil and gas as well?

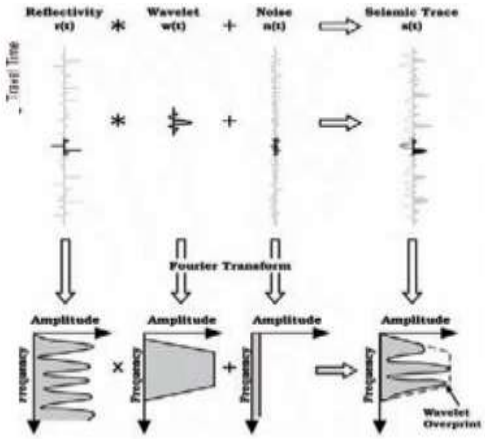

Fig-1: Short-time window Fourier transforms principle

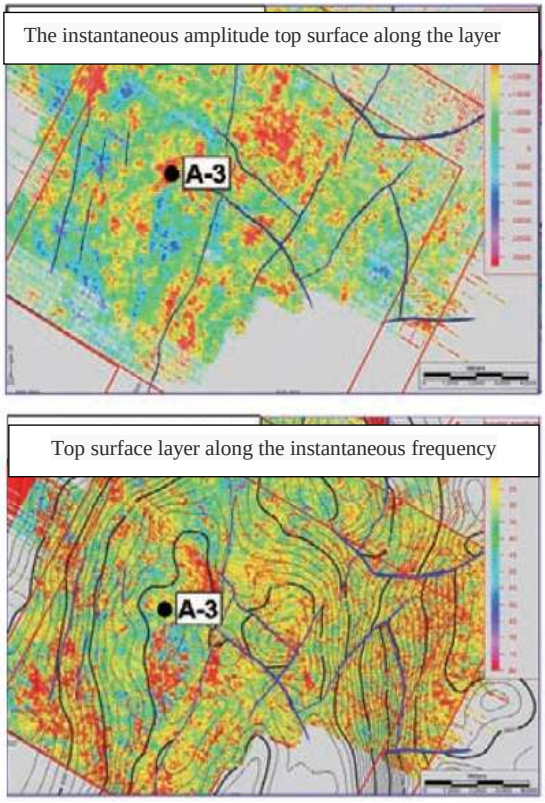

Fig-2: attribute characteristics of H6 gas reservoir seismic

A gas field due to the simple structure, only an inner structure, Exploratory A-3, and the high point of the exploration well location is not constructed. If the reservoir is not considered a problem only consider the construction, in the construction of high Site should contain oil and gas; considering changes in reservoirs, exploration Well A-3 in the development of tens of meters thick reservoir can not be away from the well Twelve hundred meters disappeared, then change this seismic attribute

Changes may not reflect the lithology and hydrocarbon potential of PH in oil and gas fields we have encountered this kind of seismic attributes Hair Health situation changes, this change is due to reveal drilling reservoir changes in the physical properties and thickness caused a seismic amplitude attenuation and very Sex reversal, then A change in this field seismic attributes will. It does not reflect the relationship between the thickness of the reservoir in response to the tuning and earthquakes it? We use spectral decomposition techniques were H6 gas reservoir storage Layer on.

First, H6 top surface of the interpreted horizons opened up when Window 20ms, downwardly open when the window 60ms, this time period to Seismic data is converted to the frequency domain, and strike each integer frequency seismic intensity distribution, shown in Figure 3, where the red represents the frequency high response strength, strong tuning effect, in turn weakened. From the figure Seen in the vicinity of A-3 well in response to the frequency of high-intensity focused in 30-40Hz, according to the tuning frequency and tuning thickness relationship, tuning time available thickness 12-16ms, and A-3 have been drilled well similar data. Further according to the frequency response of the different positions strength can get to tune the thickness of different locations. Finally H6 gas reservoir has been calculated tuning frequency distribution (Figure 4). As can be seen from the figure H6 tuning frequency distribution vary widely, Figure A-3 frequency tuning in the vicinity of the well is about 36Hz, the corresponding, the sand thickness is approximately 40 meters; located in the south tectonic highs set corresponding to the tuning frequency is around 45Hz, sand thickness may thinning; and A-3 well in the tuning and configuration point between South High Frequency Rate is very low, and intermingled some of the high-frequency information, instructions here Sand may vary widely, reservoir thickness should be more A-3 well is thicker.

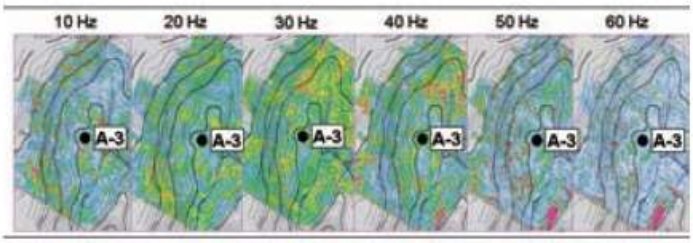

Fig-3: H6 gas reservoir in different frequency amplitude response intensity

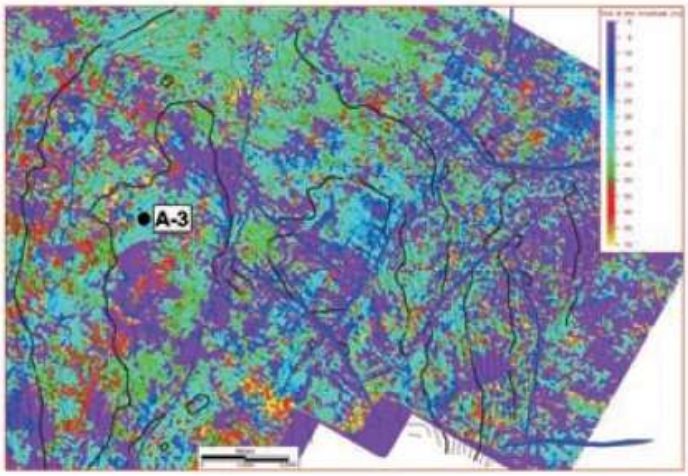

Fig-4: H6 humorous frequency distribution of gas reservoir

UNDERSTANDING AND CONCLUSIONS

The use of spectral decomposition technology to solve the conventional seismic frequency not high and low resolution of problems in the identification and conventional thin reservoir no earthquake should have a good response on the good reservoir identification Effect.

- The use of spectral decomposition techniques can be time-domain seismic, Go frequency domain data by the response intensity of a specific frequency display, observation and analysis of different frequencies at different targets in vivo Time and space changes on the extension of the case, the actual earthquake, Logging, drilling, coring and other information comprehensive analysis of calibration, can customize view predict heterogeneous body vertical and horizontal distribution.
- The use of spectral decomposition can be the target body tuning frequency distribution, then get time tuning the thickness of the target body can in the body of the target reservoir thickness good predictor.
- The use of spectral decomposition in A gas field H6 hid Bank analysts believe RESERVOIR, Reservoir south high point of presence, reservoir thinning. Reservoir thickness greater lateral variations in the A-3 wells and structures reservoirs made between the high point of the South may thicken multiple sets of stacking sand.

A result of the field H6 gas reservoirs for reservoir analysis needs to the south drilling appraisal wells to confirm the high point of the predicted results can be Reliability, if successful appraisal wells drilled, spectral decomposition technology will reservoir forecasting widespread attention and application.

REFERENCES

1. Liying, X., Mingjie, X., & Zhen., Y. (2006). Spectral points Solution technology of thin reservoir prediction of petroleum geophysical exploration, 41(3), 299-302.
2. Tsai. (2003). Spectral decomposition technology in reservoir prediction With CT Theory and Applications, 12(2), 22-25.
3. Qian-sheng., C. (1979). Mathematical Principles of digital signal processing. Beijing: Petroleum Industry Press.
4. Par., T. G., Gri., J., & Lopez., J. (1999). Interpretational Applications of Spectral Decomposition in Reservoir Characterization. The Leading Edge, 18(3), 353-360.