Introduction

The Triassic Formation in block 206 in Lunnan Oilfield is well developed, the mainly sedimentation system is braided river delta deposit, the well developed underwater channel is the main reservoir. Based on the analysis of The Triassic Formation in block 206 in Lunnan Oilfield, the block has the following problems: The first is that the sandbody is well developed, but the lateral changes greatly, it is difficult to understand the lateral superposed relationship between the sandbody; Secondly, the quality of seismic data is poor, the lateral resolution of seismic data is low and the sandbody boundary is difficult to accurately identify; Thirdly, the oil control factor is complex in Triassic reservoir, oil and gas distribution is not clear.

Methods

In order to solve these difficulties, we use constraint inversion based on model as the main means of sandbody prediction, multiple seismic attributes analysis as the auxiliary means, to those low resolution of seismic data we make process to improve resolution, and then invert data, identify the main sandbody distribution. The specific methods are: 1. the genetic analysis of sandbody; 2. the fidelity and insurance processing of seismic data; 3. multiple seismic attributes analysis; 4. the pseudo acoustic inversion.

Examples

1. The genetic analysis of sandbody

According to the regional sedimentary characteristics, the Triassic Formation in block 206 in Lunnan Oilfield is in alluvial fan-braided river delta - lake sedimentary system. There are mainly three kinds of reservoir sandbody: the braided channel microface, the front part of channel sand body microface and the beach dam microface. Vetically it is separated by stable mudstone, and can be divided into three oil groups, oil group Ⅰ, oil group Ⅱ, oil group Ⅲ. The reservoir and cap rock of three oil group combine well, reservoir changes laterally. Through the statistical analysis of each single well logging response characteristics in the study area, combined with seismic data, we conclude that wellblock 26 and wellblock 2 belong to two different depositional systems, sediment source direction are northwest and northeast, wellblock 206 is located at the joint of two sets of sedimentary systems, oil group Ⅰ belongs to braided river delta plain channel sedimentation, oil group Ⅱ is located in the braided delta front deposition, oil group Ⅲ belongs to braided river delta channel sedimentation, sandbody is well developed.

2. Seismic relative amplitude preserved processing

By seismic relative amplitude preserved processing, we improve the resolution of the seismic data, but we don't blindly improve resolution, the purpose is to improve the responsing characteristics of the sandbody, make the responsing characteristics of the sandbody more clear, it can contribute to identify sandbody accurately and determine the boundary of the sandbody, With the new processing data, we can obviously identify the superimposed relation between sandbody, oil group Ⅱ retrograded from west to east, reflection axis overlies and pinchouts obviously; oil group Ⅲ and oil group Ⅱ are similar with each other, sandbody superimposed relationship is clear (figure 1).

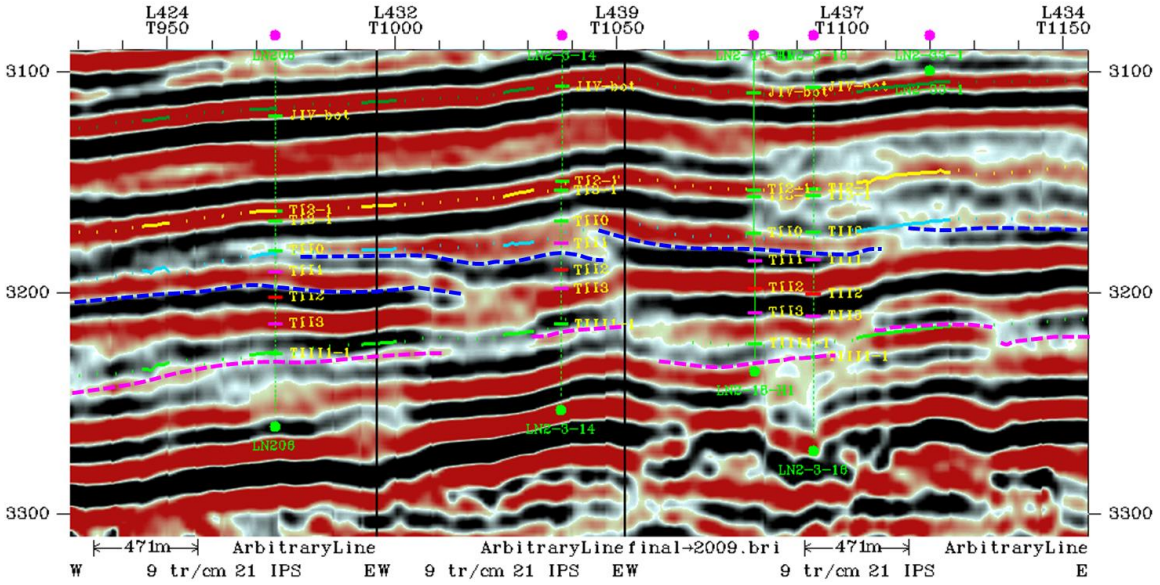

Figure 1 *superimposed relationship between sandbody*

3. Mutiple seismic attribute analysis

Seismic attribute has the technical advantages in fast identifying the form of the reservoir, the choice of the property is very important, we must choose the attributes highly accordance with the drilling in the research area from a variety of properties, if it is not well chosen, it can increase the interference information, it will not only increase the amount of calculation, but also reduce the precision of reservoir prediction. According to the actual situation in the study area, we choose the root-mean-square amplitude, instantaneous phase, waveform clustering and other seismic attributes to analyze, and according to the principle of by known to unknown, from the viewpoint of the law of depositional, we make it clear the distribution of sandbody. From the accord degree with drilling analysis, the attribute changes have better reflection on the changes of sedimentary environment. We counted the relationship between the amplitude value and thickness of sand body of TⅠ, TⅡ, TⅢ layers , we can see clearly that the amplitude value changes with the thickness of sandbody value, the amplitude value first increases and then decrease with the increase of thickness of sandbody, when the sandbody thickness value is about 20 m, the amplitude value reaches the maximum.

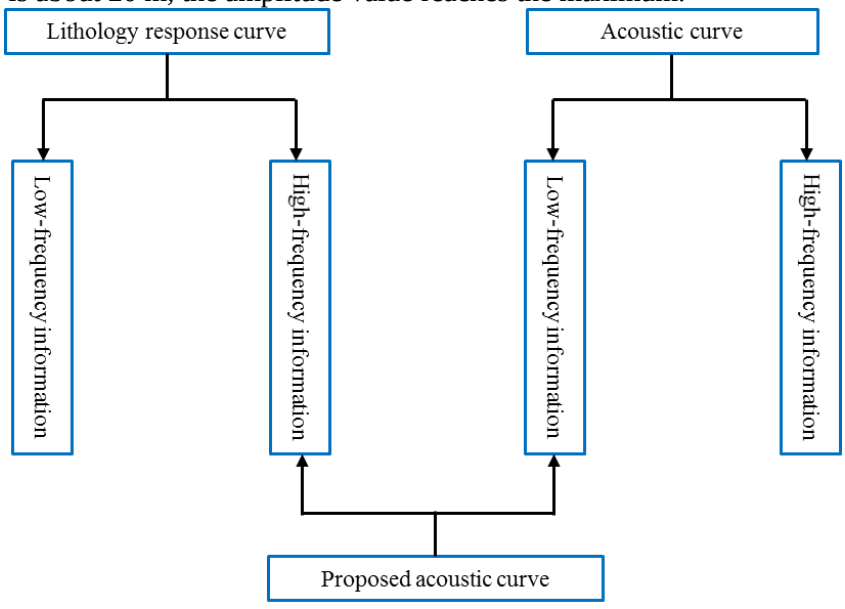

Figure 2 *acoustic curve constructing principle diagram*

4. The pseudo acoustic inversion

The author applied EPS reservoir prediction software, using the wave impedance inversion based on model.

Through repeated calibration and correction, complicated reliable geological model is set up, after doing acoustic inversion, ultimately we get high-resolution acoustic velocity and wave impedance data that can sensitive reflect the reservoir lithology and physical propertie. There are three key steps in pseudo acoustic inversion in block 206 in Lunnan Oilfield: The first is the collection and pretreatment of basic data. We Choose pure wave data that is fidelity image processed, has good signal-to-noise ratio and resolution and has wide effective frequency band, and then according to reservoir characteristics of objective strata in the study area we get sensitive parameters of the reservior, and pretreat them, based on the acoustic low frequency component, synthesis pretreatment can not only reflect the bottom velocity and wave impedance changes, and can also reflect sound wave curve with subtle lithologic differences (figure 2); Secondly, well logging and seismic finely calibration. Through interactive scanning technology with wavelet inversion and horizon calibration, we get the best calibration and the best wavelet, and make synthetic seismogram and seismic trace best matched; Thirdly, we use sound wave curve and structure interpretation framework to build initial wave impedance model, use the inverse optimization algorithm and empty wave constraint inversion to get wave impedance.

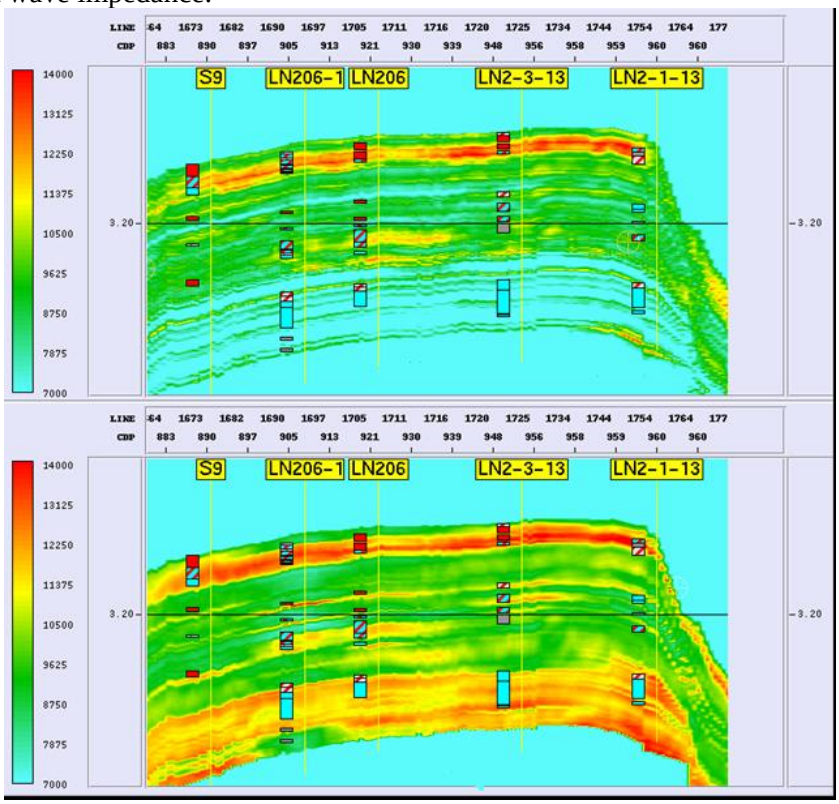

Figure 3 *Wave impedance inversion result contrast figure of original acoustic curve (top) and pseudo acoustic curve (bottom))*

5. The analysis of effect

By contrasting two sets of inversion data that get from original AC curve and pseudo acoustic curve inversion (figure 3), we can clearly see the inversion profile through AC that it can't well distinguish thin layer, the pinchout of sandbody is not clear laterally, the superimposed relationship between sandbody can't be reflected, and it can't accurately describe the 3-D distribution of sandbody; Relatively, in pseudo acoustic inversion profile, thin sand layer of the TⅡ layer of each well can be

clearly presented, whether the thickness of sandbody, or the lateral distribution range of sandbody, superimposed relationship is in accordance with drilling datas.
By using SP curve and AC curve we make pseudo acoustic curve, with the curve to make reservoir inversion, we can get the inversion data that can better reflect the characteristics of the reservoir in the area, and make tracking interpretation of sandbody in the section, crossing well wave impedance section clearly reflects the TⅡ1-1 and TⅡ1-3 sandbody distribution and pinchout of block 206 in Lunnan Oilfield; On the wave impedance inversion attribute figure, the red - yellow area in 26 wellblock and 206 wellblock in lunnan area reflects subchannel sandbody well developed in the delta front area, at the same time it reflects that the two area belong to different sedimentary systems, it provides the basis for looking for the lithologic reservoir, and blue - green areas is shale development area, the phenomenon of thick and thin sandbody characteristics, and pinchout is clear, the planar prediction is highly coincides with the drilling datas.

Conclusions

1) Sand sculpture is the main technology to identify the lithologic trap of using seismic data, the key is to well understand the seismic response laws of formations under different sedimentary conditions, thoroughly analyze seismic data of high signal-to-noise ratio, establish a reasonable depositional model, using multiple seismic attributes analysis to identify single sandbody;

2) For the thin sand layer type in the Triassic Formation in block 206 in Lunnan Oilfield, high resolution logging constrained inversion and multiple attribute seismic analysis is effective for reservoir prediction, and has achieved good effect in practical application, for the same type of area it has a certain reference significance.

Acknowledgements

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References

Mcpherson J G, Shanmugam G, Moioia R J. Fan-deltas and braid deltas: varieties of coarse-grained deltas [J]. Geological Society of America Bulletin, 1987, 99 (4) : 331-340.
Nemec W, Steel R J. Fan deltas: sedimentology and tectonic setting[M]. London: Blackie and Son, 1988.
Ricker N. The form and nature of seismic waves and the structure of seismograms [J]. Geophysics，1940,5(4): 348-366.
Kalweit R S,Wood L C. The limits of resolution of Zero-phase wavelets[J]. Geophysics,1982,47(7): 1035-1046.