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Characteristics of Sedimentary Facies Distribution of Shen 161 Wellblock S_3^2 Ⅰ Oil Group

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Abstract: Shen 161 Wellblock is now in the middle and later periods of the development, whose purpose is to improve the recovery efficiency. The single well data were used to identify the different sedimentary microfacies and their distribution roughly. Then, the theory seismic attribute technology was used to analysis the characteristics of different sedimentary microfacies' distributions, the scope and boundary of the development area were determined. Guided by the phase-controlled theory, the sedimentary characteristics were learned in the article. There are underwater distributary channel, sand sheet, mouth bar, distributary bay between four kinds of microfacies in the work area, and the first two are the most widely development, are also the enrichment area of the sand body, likely to be the favorable reservoir.

Keyword: *Shen 161 wellblock; sedimentary microfacies; seismic attribute*

I. INTRODUCTION

Shen 161 Block is in the Xinmin County, Liaoning Province. It is surrounded by Rongshengpu Depression, Shen 161 Fault, Shen 69 Block and Jinganpu Oil Field from the south, north, west and east directions separately [1]. The sedimentary face types in the study area are mainly braided delta front subfacies, underwater distributary channel, mouth bar, interdistributary bay and sand sheet, and these four microfacies types were all found in the research area. Seismic attributes is used to determine the distribution of different sedimentary microfacies area and boundary in this article.

II. SEDIMENTARY FACIES

The well-logging can reflect the sediment lithologic, so the SP and ROX curves were used to be studied in this essay. Four kinds of curve shapes were distinguished through comparing in well-logging curves in whole works area, which are trunk or bell shape, funnel shape, sawtooth shape and sharp-fanged shape (Tab. 1).

2.1 Trunk or Bell Shape

An obvious erosion surface can be seen at the bottom of the trunk or bell shape curves, and the sand grain size becomes smaller and smaller from bottom to top, appears as a positive rhythm. There would also be two or more bell shape curves stacked vertically because of there were sand bodes belongs to different times, the later one eroded the former one and after that the deposition process continued. The particle size of main sediments is from fine-grained to coarse grain, and nearly all the mud stones are gray or black. All in all, it can be defined that this kind of curve reflects the microfacies of braided distributary channel.

2.2 Funnel Shape

The funnel shape is exact opposite of the bell model, on behalf of the depositional cycle characteristic of rhythm, the grain size of which becomes bigger smoothly when going up, and has a mutation boundary

surface on the top. This kind of curve usually appeared by itself and the formation of its surface is a quickly change of the sedimentary environment, river changed flow direction after sand bodies piled up, so much mud deposited in the position of original river mouth because the hydrostatic sedimentary environment.

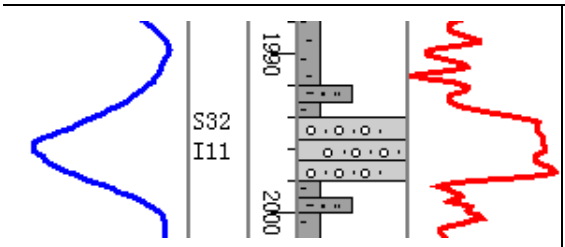
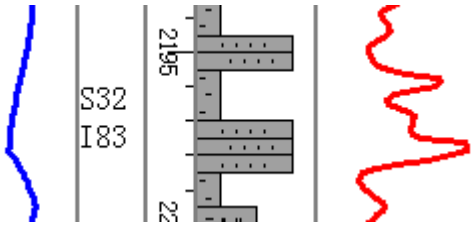
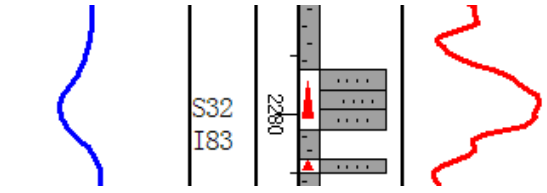
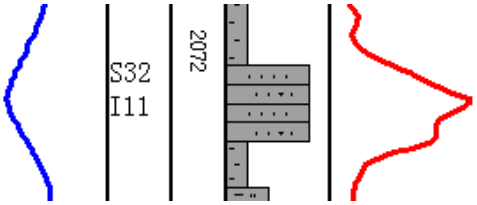
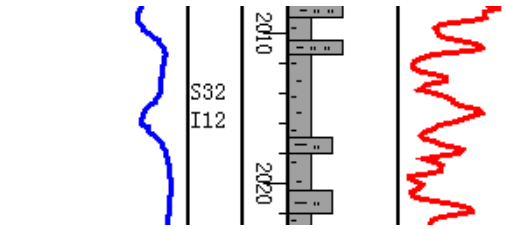
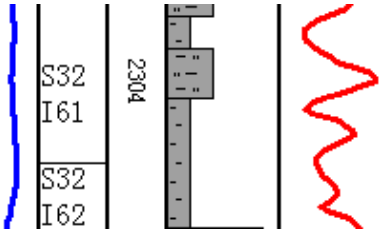
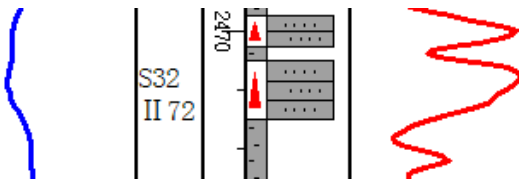
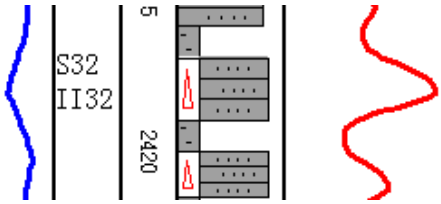
2.3 Sawtooth Shape

Sawtooth shape, a reflection of sand-shale thin interbed series, has the main character of irregular and low rolling jump form. The mud stone is gray and black learned from the mud-logging data, and the siltstone is the dominant lithology. Only in the hydrostatic or weak hydrodynamic depositional environment it can deposit, so this kind of curve is corresponded to the interdistributary bay deposit.

2.4 Sharp-fanged Shape

The shape of sharp-fanged is a sign of sediment granularity changed rapidly, reflecting a very thin sand-shale interbed. The two main kinds of lithology in this curve are fine sandstone and mud stone, which can be learned from the log and lithologic data. A short time of sand deposition is the most important character of the sedimentary facies, so it should be considered as sand sheet micro sedimentary facies.

Tab.1 log phase mode of Shen 161 Well Block

	
Trunk Shape (Well 43-55)	Bell Shape (Well 42-55)
	
Funnel Shape (Well 44-56)	Funnel Shape (Well41-63)
	
Sawtooth Shape (Well 43-55)	Sawtooth Shape (Well 41-63)
	
Sharp-fanged Shape (Well 44-56)	Sharp-fanged Shape (Well 41-63)

III. SEISMIC ATTRIBUTE

3.1 Development Situation

The original meaning of the seismic is the prestack or post stack transformation of the seismic data[2]. After the transformation it will reflect the seismic wave in the aspects of geometry, kinematics, dynamics, and statistics[3]. Stratigraphic lithology and lithofacies analysis, physical property analysis and reservoir capability analysis, these three are mainly what seismic attribute researches at the present stage[4]. It will alter because of the variation in space of rocks and pore fluid[5], and the corresponding mapping relationship can be build through calculation. This way, the reservoir information can be predicted using the seismic attribute, and as the progress of science and technology, the prediction theory of seismic attribute was frown from single to multiple, from quality to quantity[6-8]. Unfortunately, because of the complex geological environment underground, it might not confirm but just prediction and the error is inevitable[9-11].

3.2 RMS & Energy

At first the RMS amplitude which extracted by the software in the Shen 161 Wellblock of S_3^2 Ⅰ Oil Group as well as the seismic attribute of Average Energy were named SENIO (Fig. 1&2). Because these two seismic attributes belong to the same series, undergo the similar operation process, and were calculated by the similar mathematical formulas in a semblable mathematics environment, Fig.1 and Fig.2 look show similar characteristics by the color distribution which shows in the same way. So, to some extent, there must be high similarity among the seismic attributes in the same series.

In the two pictures, the blue color means low amplitude or energy, the bluer, the weaker. On the contrary, the red color shows the place where large amplitude or high energy. The intensity of amplitude range from 41.815 to 68.745, while the average energy within the scope of 1610.740 to 4541.314.

According to previous research results that there must be a definite relation between the variation of stratum and the change of the seismic attributes which belong to the series of amplitude. So we could confirm the good places for sand bodies by the distribution of red color, we can blurred the Fig.1 or 2 and use which as the sandstone distribution maps.

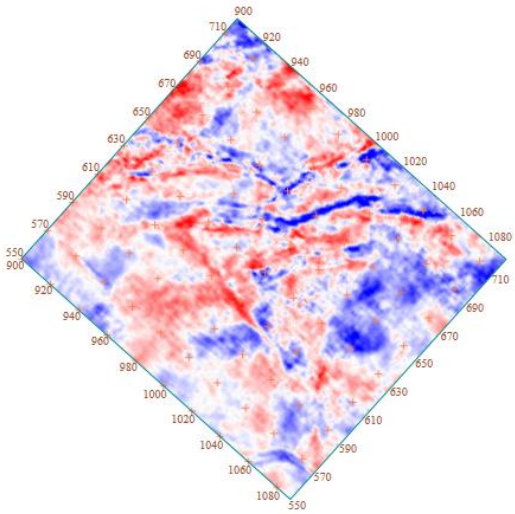


Fig.1 RMS Amplitude

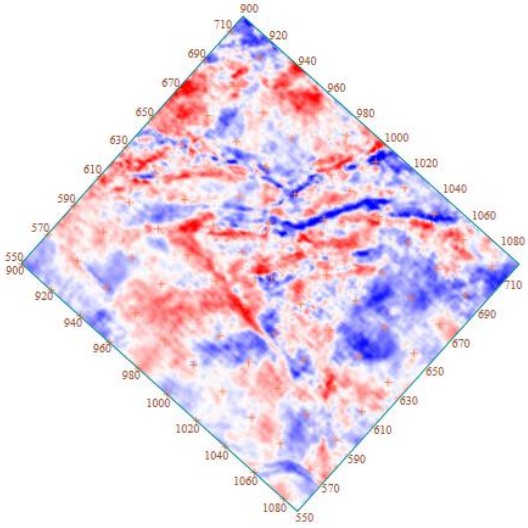


Fig.2 Average Energy

It can be clearly observed in the picture that in the northwest part of the work area, a large amount of sand rocks are deposited, and there is a trend of decline of sandstone content towards the direction of southeast. The

situation can be explained by the following; hypothesis: the provenance is from the northeast of the work place and there are some branching rivers extend to the middle of the study area and disappeared gradually. According to the rules of facie model, it can be predicted that a mount of mouth bars might be found in the middle of study area, and there would be thin sheet sand bodies in a uniform distribution. The sedimentary characters of sheet-sand microfacies stand for the weak seismic energy.

3.3 Effective Broadband

After the analysis of RMS Amplitude and Average Energy, another seismic attribute was extracted for further research, the Effective Broadband, which ranges from 7.236 to 22.066 and reflects the change of lithology (Fig.3). The study area can be divided into two parts on the basis of the Effective Broadband Map, the yellow & green part and the blue & gray part. The rocks in the two parts might be different, and the difference reflects the transform of sedimentary facies and sedimentary environment. In the yellow even red part, the data of Effective Broadband are in a high level and show the lithology changes quickly, the environment is in a large variation. On the contrary, the situation in blue part might be much smoother with stability lithology.

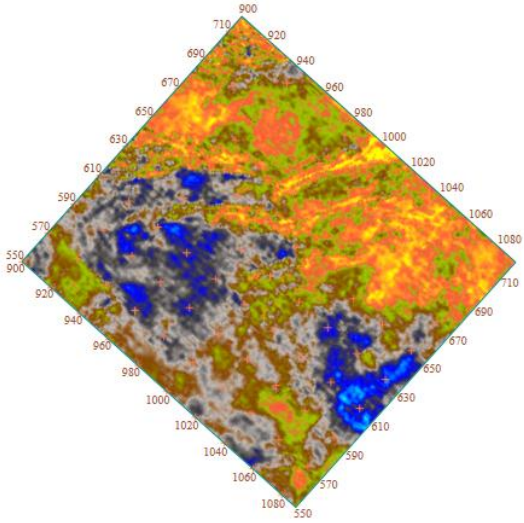


Fig.3 Effective Broadband

3.4 Next two seismic attributes we selected are Average Reflection Strength and Arc Length. The two attributes are also in high consistent with the trend of the underground condition changes that we interpreted.

The Average Reflection, one of the plural statistics class, bounded abnormal amplitude to some special geology phenomena, as salt dome and diluvial fan. The spectrum class seismic attribute Arc Length can distinguish the different intensity of amplitudes, which is really useful when identifying the sand bodies.

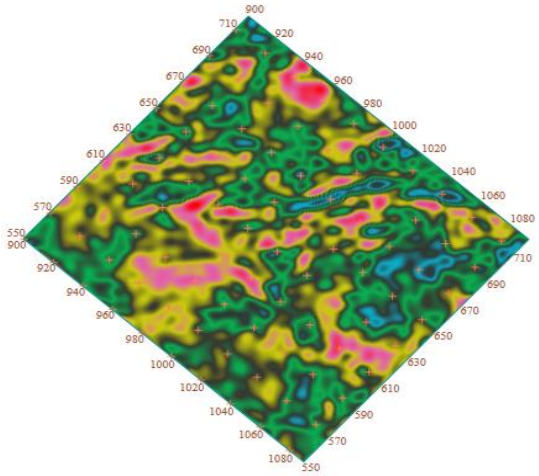


Fig.4 Average Reflection

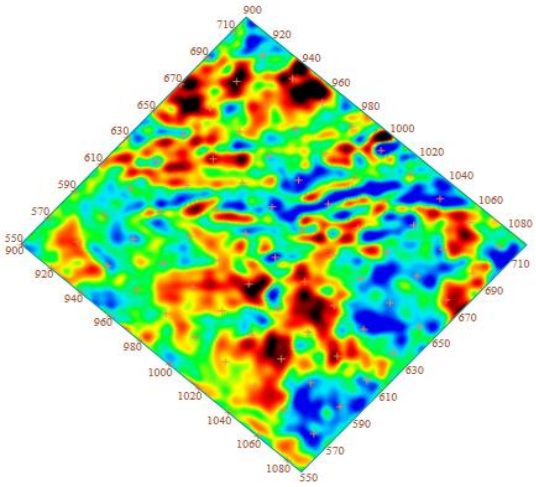


Fig.5 Arc Length

3.5 Summary

Guide by the model of braid-river delta front subfacies and the learning of the seismic attribute, three conclusion made as follows: first, the course of rivers in the work area is from northwest to northeast; second, underwater distributary channels disappeared in the center of the work zone; the last one, there are large tracts of sheet sand in the northeast part of the study region, whose area is over one fifth of all.

IV. SEDIMENTARY DISTRIBUTION

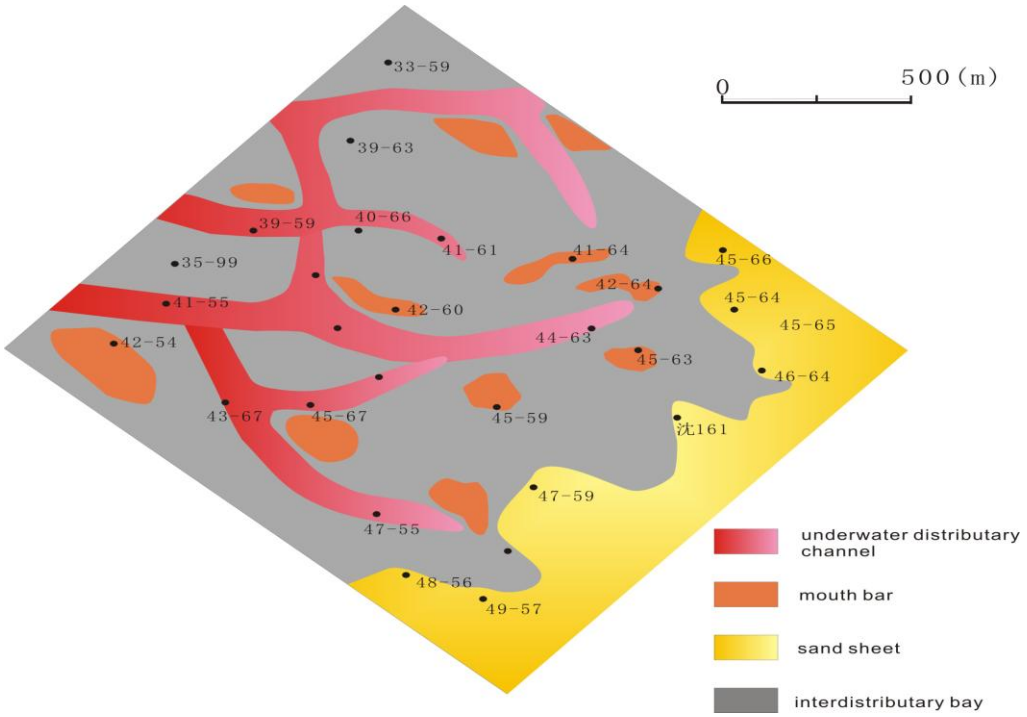


Fig.6 The sedimentary microfacies map of S_3^2 Ⅰ oil group Shen 161 Well Block

The sedimentary microfacies map was drawn with the help of well logging, mud logging and seismic attribute data (Fig.6). We can see clearly from the map that there are three main channels in this area. The first one entered the work zone near the Well 41-55, and divided into two secondary tributaries, the first tributary went

through the Well 43-67, and vanished near the Well 47-55 and Well 45-67 separately by third order tributaries. The other one flowed by Well 41-66 and ended at Well 44-63.

The second main channel flowed into the work area in the position of Well 35-99, and it also has two subordinate tributaries. One went through Well 40-66 and ended near Well 41-61, the other went through Well 41-60, and then flowed into other channels. The length of this main channel is shortest, which is also the most rudimentary one.

The last main channel came into the zone in the position of Well 39-63 from northwest, which was divided into two tributaries after entering the area and one of that disappeared near the Well 41-63.

The sheet sand developed within the limit of Well 45-66, Well45-64, Well46-64, Well Shen 161, Well 47-59, Well 49-57, Well 48-56, northern and eastern boundary of the study area. The mouth bar sedimentary microfacies is at the place of Well 42-54, Well 47-56, Well 45-59, Well 42-60, Well 42-60 and next to the Well 36-65, W43-67 and so on.

V. CONCLUSION

1. There are four kinds of sedimentary microfacies in the study area, which are underwater distributary channel, mouth bar, interdistributary bay and sand sheet.
2. The river channels are in the northwest part of the work zone and the channels become thinner and disappeared in the center of the area.
3. The sedimentary microfacies of sand sheet is in the opposite part of the study area and account for more than one fifth of the area.
4.The mouth bar developments in the middle or ant the terminal of the river channels.
5. The constitution of favorable reservoirs are underwater distributary channel and sand sheet, where can be bounded by the sedimentary microfacies maps.

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