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Three-dimensional Geological modeling of Toutai oilfield's Fuyu reservior Z11 block

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Abstract: Reservoir geological model is the core of the geological model of the reservoir, is the specific characterization of reservoir characteristics and heterogeneities in the three-dimensional spatial distribution and change. Reservoir modeling is actually establish reservoir properties of reservoir parameters characterizing the three-dimensional spatial distribution and change models. Reservoir parameters include porosity, permeability and oil saturation, reservoir thickness. The purpose of the establishment of reservoir parameter model is through quantitative research on porosity, permeability and thickness of the reservoir, precisely defined spatial location and distribution of favorable reservoir, which directly provide direct the development and adjustment of oilfield development plan geological basis.

Keywords: reservoir geological model, three-dimensional spatial, oilfield development.

INTRODUCTIN

Exploration and development of the increasingly serious situation, so that our land has been quite a lot of old oil fields after years of development and production into the high water content, high recovery degree of "double high" phase, but in the development phase of oil production and reserves the contribution is still large, the remaining recoverable reserves of tapping the potential is still an important measure of the current old oil field development, which made the second development philosophy: the application of new technologies, new methods, new ideas to rebuild the old oilfields new development system substantial increase in oil ultimate recovery, the old oil onto the road of sustainable development. Secondary development of one of the core technology is to re-build the underground system know how to construct detailed 3D seismic reservoir characterization and reservoir description, features and other fruit for distribution of remaining oil research, deepen the understanding of the distribution of the remaining oil, three-dimensional geological modeling that is the only means.

ESTABLISHMENT OF STRUCTURAL MODELING

Conventional construction process of ideas for modeling work, first under the control of the breakpoint data, the use of depth of field to explain the fault data to establish fault model. Complete "Pillar griding" after meshing in the correction well hierarchical data using depth of field seismic data interpretation horizon, the horizon interpretable Hrizon established. After the "Make zone" in the process, by the well stratified layers of other small surface interpolation will be established. Finally, divide the longitudinal grid, making modeling work to complete the work.

Under the guidance of the early understanding of the geological studies, the present tectonic modeling work completed study area 8 fault, tectonic modeling work 23 deposition unit. Follow the guidance of geological hierarchical data, taking fully into account the combination of space and well breakpoint fault, repeated adjustment between the fault and the fault, contact relationship between the fault and the layer between layers and layers, the final completion of 20m × 20m × 0.5m grid structure model accuracy.

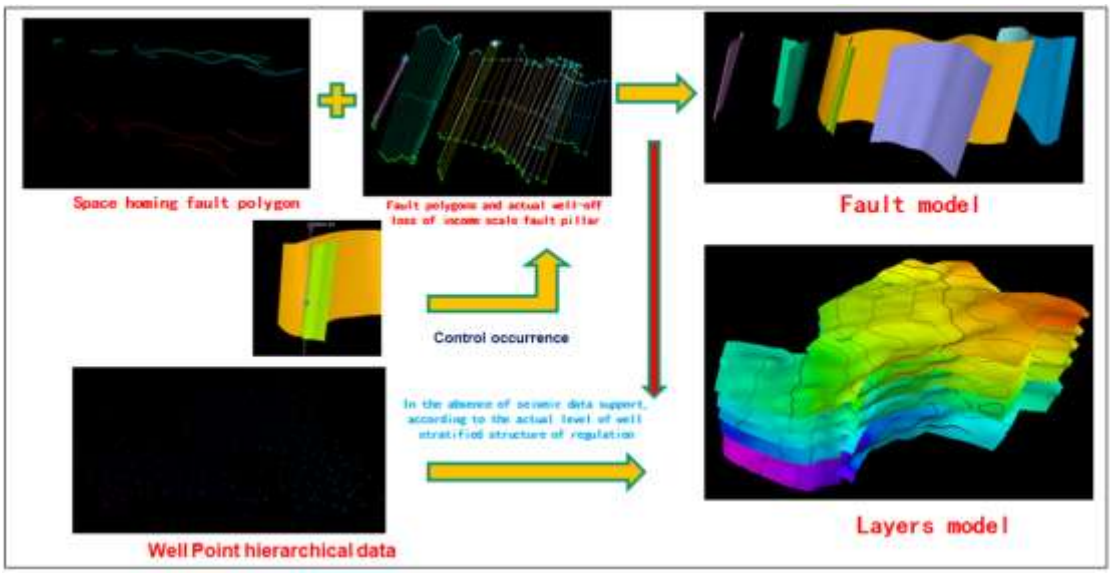

Fig.1 Establishment of structural modeling

Fault model and breakpoint combination

In this work to establish fault model, the main advantage of the two types of data: the scene to provide a top surface fault distribution data (no seismic interpretation horizon data), and the breakpoint fault polygon data. Fault polygon data space after homing is displayed on accurate fault plane can be used to assist fault pillar adjust the inclination and direction in establishing fault model; at the same time, break data compare well to get even is to control the position of the fault model hard data, in the establishment of fault model, the fault must be combined therewith.

When adjusting the fault pillar to pay attention to the following questions:

1. Note that the breakpoint plane distribution location, analyze whether it is reasonable, whether the impact in the study area.
2. According to the regional stress field and tectonic characteristics of research, the work area of all fault normal fault, the fault pillar in the regulation must prevent the emergence of reverse faults.
3. The same situation can not fault the rise and fall of the disc tray reverse occurs.
4. Fault pillar connection with construction faults figure consistent polygon, reasonable connection.

According to the foregoing even well Comparative study, concluded that after the expansion of the outer zone Z11, a breakpoint 8: After expanding outside the study area, a total contrast to give seven breakpoints, where Z11 breakpoint region totaling is 4.

Each breakpoint data: Z29-77 well breakpoint sounding 1350.74 m, Z20-78 well breakpoint sounding as 1360.23 meters, Z4-84 well breakpoint sounding as 1370.24 meters, 68-S84 sounding as well break 1410.35 m, Z50-87 well breakpoint sounding as 1250.68 meters, X63-S92 sounding well as 1196.51 meters. In this structure modeling process, will be classified as a known fault in space, the full realization of complete combination with breakpoints, the breakpoint falls entirely on the fault plane, fault on both sides of stratigraphic distribution of smooth, uniform thickness, tectonic model good quality.

"Pillar gridding" gridded

In the modeling process, the grid shape, size and orientation, and affection to the grid or generate sedimentary facies model and property models. Therefore, a reasonable grid design is very important. Petrel software uses the corner points of the grid to build complex geological model. By generating detailed 3D geometric latticework, in the master module in applied geology and geophysical information to establish and divide zone, build a three-dimensional model of stratigraphic framework. In the course of the grid, on the relationship between the vertical relationship and the level of exposure levels and the section between fully taken into account, which is well protected between various parts of the internal model consistency and integrity, while ensuring reservoir simulation model grid orthogonality. In the grid size design, on the one hand fully reflect the following information (structural levels and logging well spacing) premise accuracy is limited by the operation speed of computer hardware, the grid should not be too small; on the other hand in order to meet needs and to ensure that small-scale simulation of random sand reservoir modeling precision grid should not be too large. This time modeling work in accordance with contract requirements, using a 20m × 20m × 0.5m of the grid resolution scheme.

ESTABLISHMENT OF SEDIMENTARY FACIES MODEL

The study of sedimentary facies modeling approach is: first sedimentary facies diagram digitized

and input to the petrel software. Then digitized phase code data into code for surface phase. Finally, the method of phase modeling assignment module (Assign value), the phase data assigned to each of the small layer mesh model corresponding layers to go. The sedimentary facies sedimentary facies model is constructed model grid diagram in space assignment, it is on a plane with sedimentary facies diagram is consistent. Since the early work in the sedimentary environment of the study area, tectonic conditions and source direction for a detailed analysis, it is possible that this phase model can reflect the purpose of the study area in a plane layer of the various phases spread. However, this method has a drawback of the more prominent, namely due to the heterogeneity of the inner layer of the presence of sand in the whole body is not small layer development. And this method to establish the sedimentary facies model of sand appeared in the entire small layer grid, so this phase model does not reflect the changes in the vertical sand space.

This modeling is based only this method to complete the 23 established deposition time unit with the model in the study area, only Z11a, Z15a, Z21a, Z31a and other four, for example, as shown below. Further there is, the resulting phase by phase cross-sectional model, you can clearly see the changes in sedimentary facies in vertical, and lay the foundation for the subsequent phased attribute model and numerical simulation.

ESTABLISHMENT OF SEDIMENTARY FACIES CONTROL MODEL

There are many ways attribute model, such as the direct use of full physical properties such as porosity and permeability data were worse adjustment method, of course, more can be combined with a priori knowledge of the use of micro-phase deposition portrayed as a constraint to guide the establishment of the properties of the model. These methods have advantages and disadvantages.

The establishment of the main properties of the model used, combined with a priori geological knowledge, in resolution sequence stratigraphy based on the characterization of fine sedimentary micro facies plane, further explained in conjunction with logging physical parameters, data and other fluid phase under the constraint mode of the model structures. In this way, the modeling of all the geological understanding of the early are summarized in the full understanding of the study area, based on the analysis of geology statistical law, thus completing the establishment of the model. Through this model, respectively phased porosity properties of the model in the study area and permeability properties model phased, this grid-like chart with only a sectional view of display. Phased property by modeling results analysis, the modeling better reflect the spatial distribution of reservoir properties, the maximum to meet the well point data, while fully characterize the distribution of reservoir properties of space, to help understand the reservoir heterogeneity distribution, which can effectively guide field development work late.

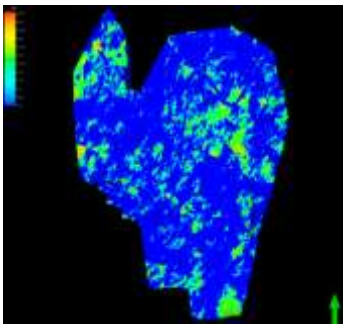

Fig.2 Establishment of control of the sedimentary facies model porosity properties

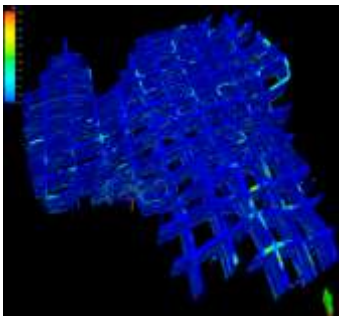

Fig.3 Palisade figure of control of the sedimentary facies model porosity properties

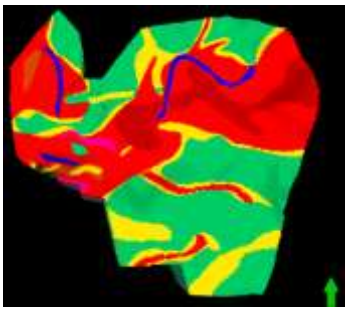

Fig.4 Establishmentof sedimentary facies ontrol model Z15 small layer

CONCLUSION

Through this modeling work, but also get following understanding:

In the absence of seismic interpretation data do support time, make the modeling results and their accuracy is difficult to grasp, it will extend the situation by affecting faults space formation address and 2.other ups and downs to influence staff understanding of the reservoir;

Secondly, modeling work, can take advantage of a priori geological knowledge, many ways to limit constraints software interpolation, it can follow certain geological law reservoir characteristics to maximize the reduction of underground distribution;

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