

Application of Geological Modeling Technology in 110 Block of Changchunling Oilfield*

Yidan Liu¹, Jun Xie², Ningning Meng², Weihua Li²

¹ China University of Petroleum, Qingdao Shandong, 266590

² Shandong University of Science and Technology, Qingdao, Shangdong 266590
ning0536@163.com

Abstract - The 110 is an ascertained but undeveloped block in Changchunling area. It is affluent in geological reserves, and has greatly development potentiality. This paper use the software of Petrel to establish three-dimensional fine modeling which include structural models, porosity models and permeability models. The model has the grid size of 20×20 m in the plane. These provide the geological basis for the next program of enacting efficient development plan of 110 block.

Index Terms - Changchunling oilfield, undeveloped block, geological modeling, structural model

1. Introduction

With the rapidly development of computer, three-dimensional modeling technology of petroleum reservoir has been the prime methods of petroleum industry making reservoir description[1]. three-dimensional quantitation geology modeling of the reservoir can reflect the characters of distribution and regularities of variation in reservoir geology space attribute. That provides geology basis for petroleum pool development^[2]. We can see from the core of rock experimental analysis in this field that 110 block reflect the features of low temperture, low pressure and high waxcontent. Moreover, 110 block is the typical representative of undeveloped one of Changchunling oilfield. Throught slecting optimizational develop scheme and design parameter of reservoir engineering for 110 block, we can arrive at the aim of gradually developing Changchunling oilfield. The paper is based on upon the existed well data to make reservoir three-dimensional fine geological modeling, and preliminary understanding the reservoir structure of this block, also supplying the geological base for efficiently rational developing this Reservoir.

2. Geological Characteristic

Chang 110 block locates in the west horseblock of Changchunling, the top structure form of Quan 4 Formation is fault nose structure which is small-scale inclining southwest, this region develops two pieces of almost vertical faults, and these extend 3~5km, fault throw is 40~70m. From the data of accomplished wells drilling, the oilfield type of research area

is lithological Structural Reservoir. The depth of reservoir varies between 210m and 350m. The Sandstone thickness of average single well is 35.9m, net pay is 8.6m; from the rmometric and manometric material, we can understand the central temperture of this reservoir is 20.5°C, the pressure is 2.63MPa.

3. Structural Model

Structural model reflects the special framework of reservoir, namely the reservoir structural model of three-dimensional space form of the inner reservoir Geologic Face, including fault model and Layer Model. This time modeling establish the grid system in plane that the plane grid size is 20×20 m, longitudinally it is divided into 25 zones according to single layer, forming 75×55 plane grid system, three-dimensional grids up to 103125, Fig.1 and Fig.2 are respective structure model and panel map of research area.

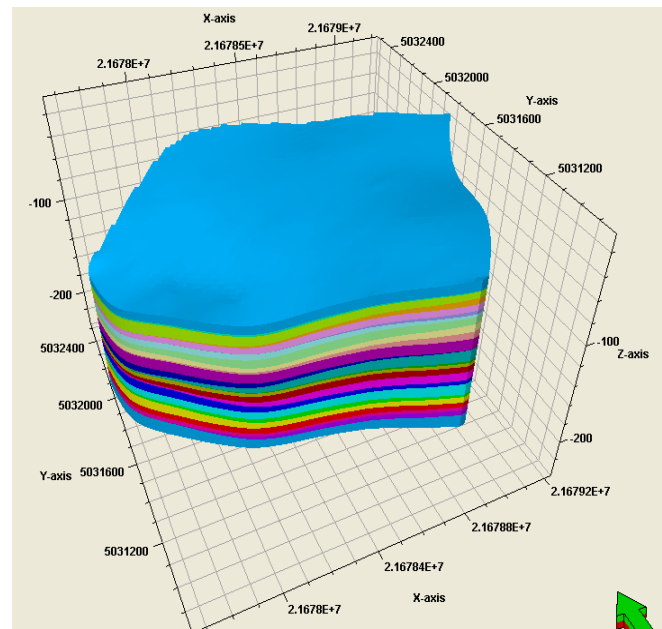


Fig.1 schematic diagram of structure model in 110 block

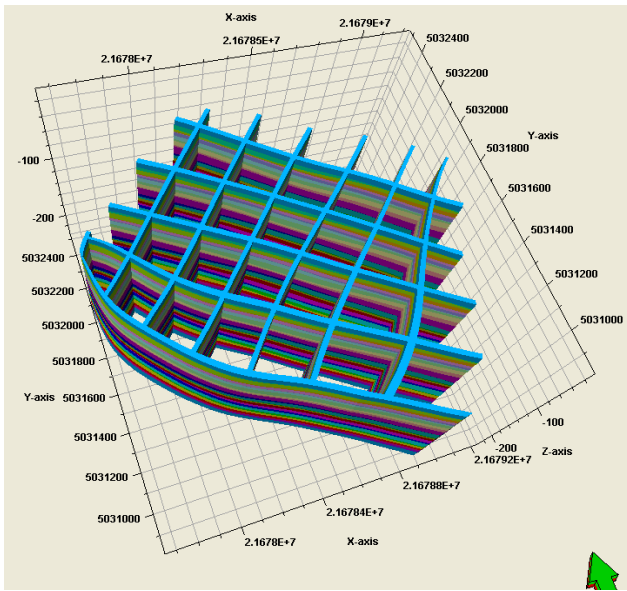


Fig.2 panelmap of structure model in Chang 110 block

4. Attribute model

Lithofacies-controlled model finally aims at establishing parameter models which can exactly reflect porosity, permeability under the earth and the special distribution of effective reservoir[4]. Attribute model needs analyse variogram and makes Prior Choice of Stochastic Modeling, using the method of sequential Gaussian simulation method which bases on collocated cokriging establishes Porosity model and permeability model[5][6].

Porosity model This area, the Sediments of Quan 4 Formation are primarily fine sandstone and especially fine sandstone, basically belong to mesopore- moderate permeability reservoir. Physical property of reservoir is relatively good, the average porosity is 24.6%, among which porosity of the second, the fifth, the seventh major single layers and so forth is comparatively big, up to about 27%. The data analysis is made respectively according to different single layer and different Sedimentary micro Facies. Above basing on the result of data analysis and acquired variogram models, regarding sedimentary microfacies as the control conditions, to establish porosity model sphase-controlled[4]. Fig.3 and Fig.4 are respectively porosity model of Chang 110 block and panelmap.

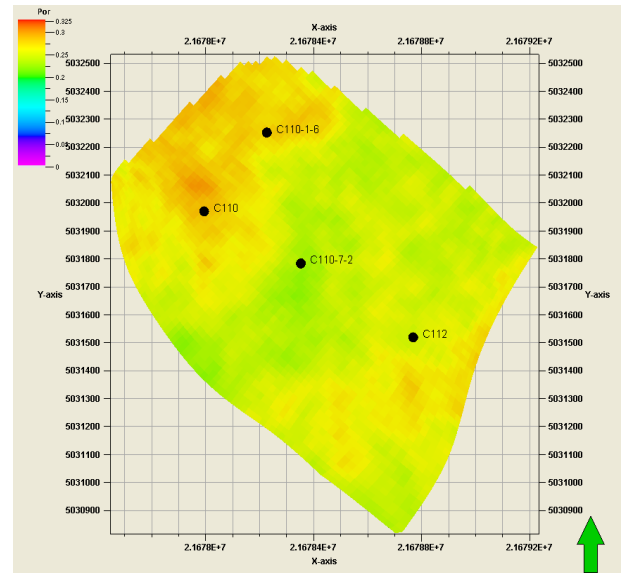


Fig. 3 planar graph of porosity model in Chang 110 block

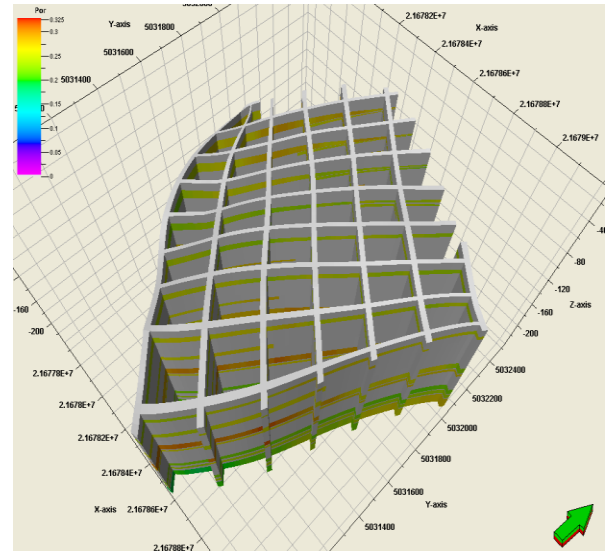


Fig. 4 panelmap of porosity model in Chang 110 block

Permeability model The physical distributions of the area are directly controlled by the distribution of sedimentary facies, the charting trends of porosity and permeability every layer both are similar to the character of the charting trends of sands' thickness, that is, porosity and permeability are greatly relative with sands' thickness or the types of sedimentary microfacies, the average value of permeability is $138.7 \times 10^{-3} \mu\text{m}^2$. The permeability of major layers such as the second, fifth, seventh, thirteenth is high, up to about $270 \times 10^{-3} \mu\text{m}^2$. Fig.5 and Fig.6 are respectively permeability model and the panelmap of permeability for Chang 110 block.

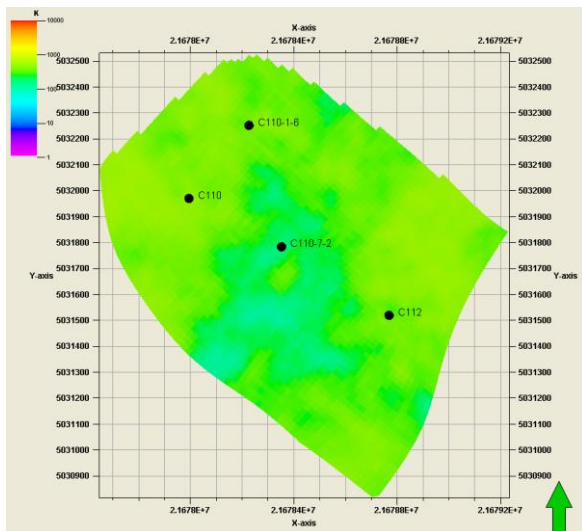


Fig. 5 planar graph of permeability model in Chang 110 block

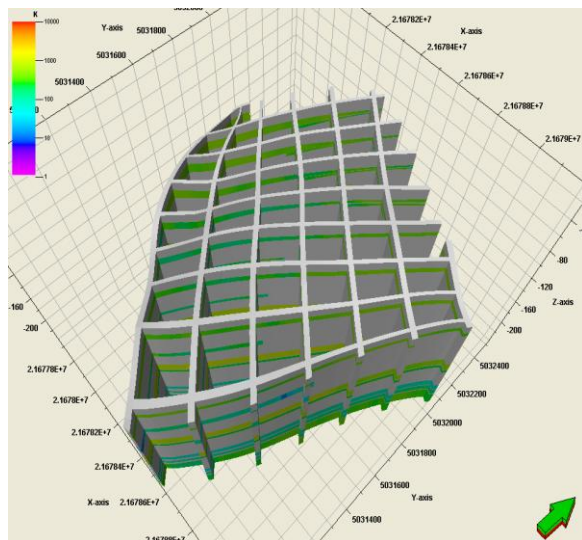


Fig. 6 panelmap of permeability model in Chang 110 block

5. Calculation of Model Volume

One of the purposes to reservoir model is to calculate the volumes and geological reserves of oil and gas the for study area according to having been established three- dimensional

reservoir models[6]. Making use of property models for Chang 110 block, such as structural models, porosity, permeability, oil bearing saturation, N/G and so on, and using the parameters of reservoir and fluid in this area, such as oil volume factors, oil density and so forth. The geological reserves of Chang 110 block get 175.3×10^4 t through calculation of reservers. From the result of reserver distribution, the reservers of Chang 110 block mainly concentrate in majory layers such as the second, fifth, seventh, thirteenth and so on.

6. Conclusions

- (1) With the software, Petrel, and adopting the reasonable modeling methods, we have established three- dimensional visualization models for study area, including Layer Models ,fault models and phase-controlled attribute models, supplying dependable geological models for numerical simulation of reservoir.
- (2) Based on having established reservoir models and distribution of fluid, through calculation, we received the petroleum geology reserves of Chang 110 block to 175.3×10^4 t.

References

- [1] Song Haijing, Hu Mingyi. Date interface technique on petro software and geological datebase. Journal of Oil and Gas Technology (J. JPI), 2009, 31(3): 217-218
- [2] Li Yu, Yang Changqing. Strategy of reservoir geological modeling and application of technical method. Journal of Oil and Gas Technology (J. JPI), 2009, 31(3): 30-36
- [3] Xie Jun, Meng Ningning, Yu Jiangtao, Lin Peng. The Research of Fine Geological Modeling for a Single Well in VII lower unit of Shuanghe Oilfield. 2009 Second International Conference on Future Information Technology and Management Engineering: 555-558
- [4] Pan Shaowei1, Yang Shaochun and Yang Bai. Application of facies-controlled modeling technology to the fault-block ZZin Jiangsu oilfield. NATURAL GAS GEOSCIENCE, 2009, 20(6): 935-940
- [5] Yang Wei, Li Lingling, Gao Junheng. Application of random modeling technique in reservoir description in Biqian10 area. Inner Mongolia Petrochemical Industry, 2010, (8): 30-31
- [6] Yu Jiangtao, Xie Jun, Meng NingNing, Lin Peng. 3D geological modeling in Chang109 block of Changchunling oilfield. Advanced Research on Industry, Information System and Material Engineering: 1891-1894