# PS The Study and Application of the Subtle Strike-Slip Fault Identification Technology in the Exploration of Miaoxinan Uplift Area, Bohai Bay Basin, Eastern China*

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## Abstract

The Miaoxinan Uplift is located in eastern Bohai Bay Basin and is an important exploration area. The Penglai 19-3 Oilfield, found in the western Bonan Low uplift, is China's largest offshore oilfield, while the Penglai 9-1 oilfield, found in the northern part of Miaoxibei Uplift, is the largest oilfield discovered in the past few years in the Bohai Oilfield. However, in the Miaoxinan Uplift area, the fracture system is very developed and the structure is very broken because of the development of the north-south Tancheng-Lujiang strike-slip Fault, the nearby (to the east) Zhangjiakou-Penglai Fault, and the Northeast Extensional Fault. Using geophysical data and forward modeling, combined with field outcrop and sandbox physical simulation, this work establishes the technological process of identifying the subtle strike-slip fault by fault likelihood attributes based on the construction oriented filtering.

Using this technique, a subtle strike-slip fault was identified in the low part of the Penglai 20-A structure, and in the Penglai 20-B structure. The PL20-B-1 well drilled in 2015, with total oil reservoir thickness of the well of 51 meters, confirmed the reliability of this subtle strike-slip fault identification technique, but also proved the feasibility of the technology. In the subsequent five wells drilled, there were about 35 meters of oil strata in each well. However, there was a contradiction between the high-site PL20-B-2 well and the low-site PL20-B-5 well. Most of the PL20-B-5 well were oil layers in the Guantao Formation, while most of the PL20-B-2 well were oil and water layers in the same formation. Using the above technology, a subtle strike-slip fault extending about 1 km was found, which solved the contradiction between the two wells. The subsequent deployment of the PL20-B-6 well found 60 meters of oil reservoir, and upgraded 6.48 million tons of proven oil reserves. In the evaluation process of Penglai 13-A structure in the northern part of the study area, a new subtle strike-slip fault was identified using the above method, and the 1.3 $km^2$ of the trap area was increased, which lays the foundation for additional well locations in the Penglai 13-A structure. With the depth of exploration, there are fewer larger structural traps, but the use of subtle strike-slip fault identification technology can find new structural traps in the development area with strike-slip faults, which will help exploration decisions. This method has achieved good application results in the development zones of strike-slip faults in the Bohai Oilfield, and can be extended to other oilfields with strike-slip fault development.

# The study and application of the subtle strike-slip fault identification technology in the exploration of Miaoxinan uplift area , Bohai Bay Basin, Eastern China

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## 1. Research background

The Miaoxinan uplift located in the eastern of Bohai Bay Basin, was an important exploration area. The Penglai 19-3 oilfield, found in its western Bonan low uplift, is China's largest offshore oilfield, the Penglai 9-1 oilfield, found in its northern part of Miaoxibei uplift, is the largest oilfield discovered for the past few years in Bohai oilfield. However, in Miaoxinan uplift area, the fracture system is very developed and the structure is very broken because of the development of the North-south Tancheng-Lujiang strike-slip fault, the Near-east Zhangjiakou-Penglai fault and the North-east Extensional fault (Figure 1).

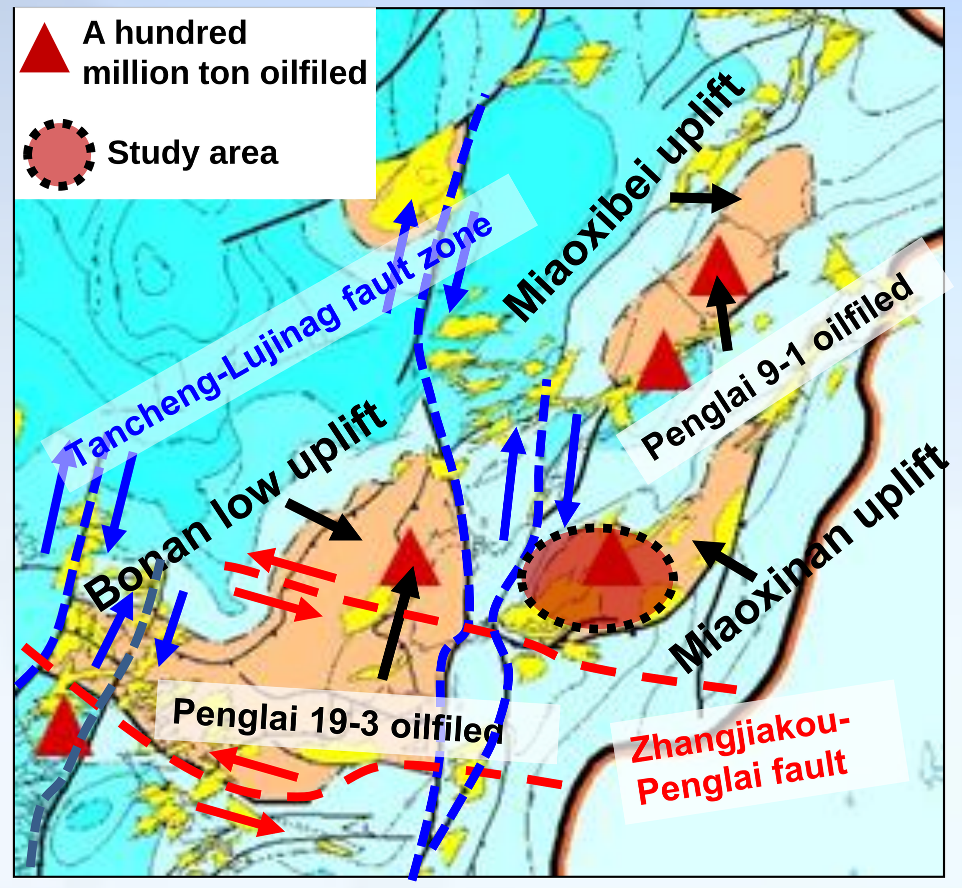



Figure 1. Location of study area

## 2. Key technologies

By means of geophysical properties, forward modeling , combined with field outcrop(Figure 2) and sandbox physical simulation(Figure 3), this work establishes the technological process of identifying the subtle strike- slip fault by fault likelihood attribute (Figure 4b), based on the construction oriented filtering.

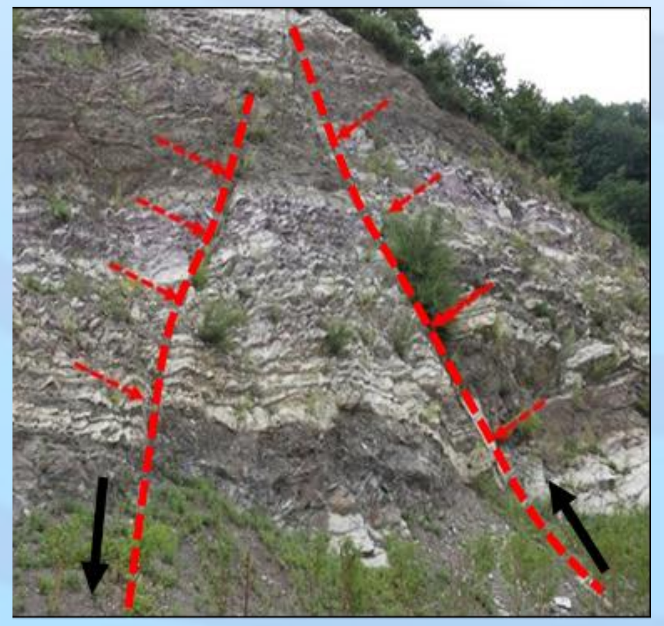


Figure 2. Characteristics of the northern Tancheng-Lujiang fault

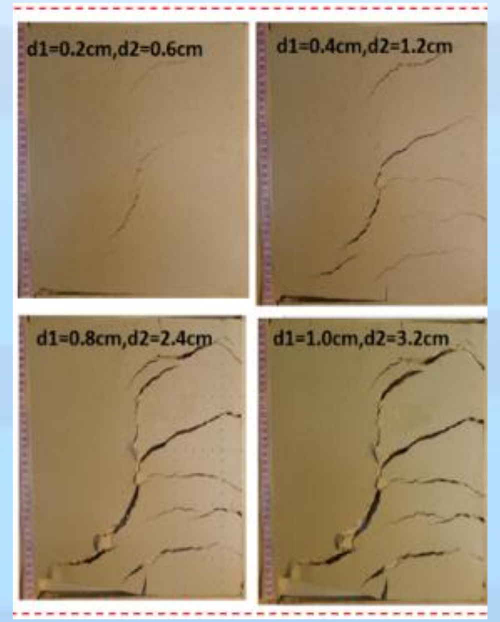



Figure 3. Sandbox physical simulation

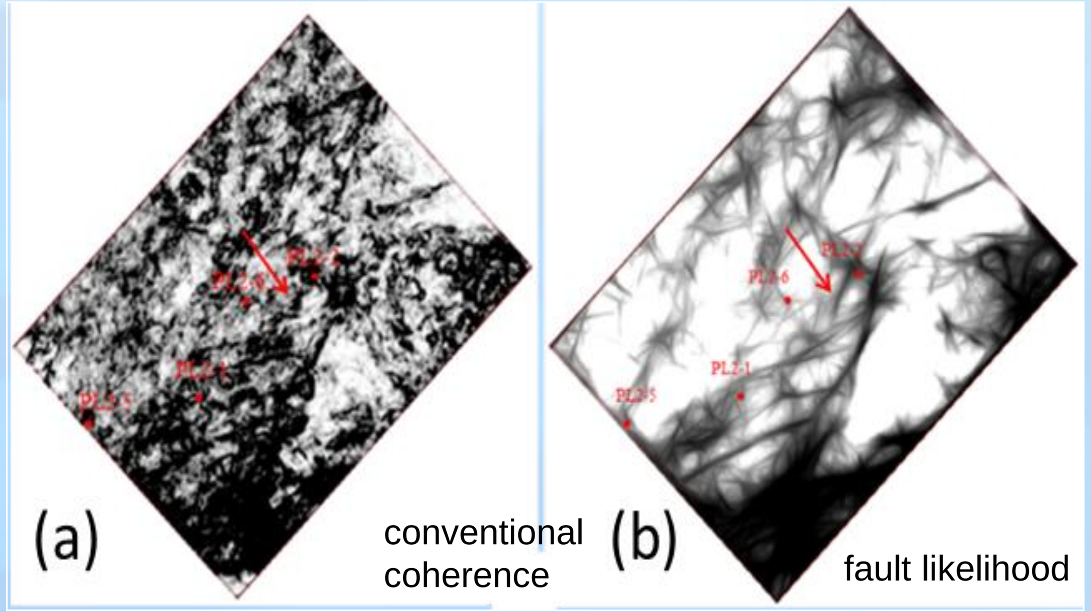


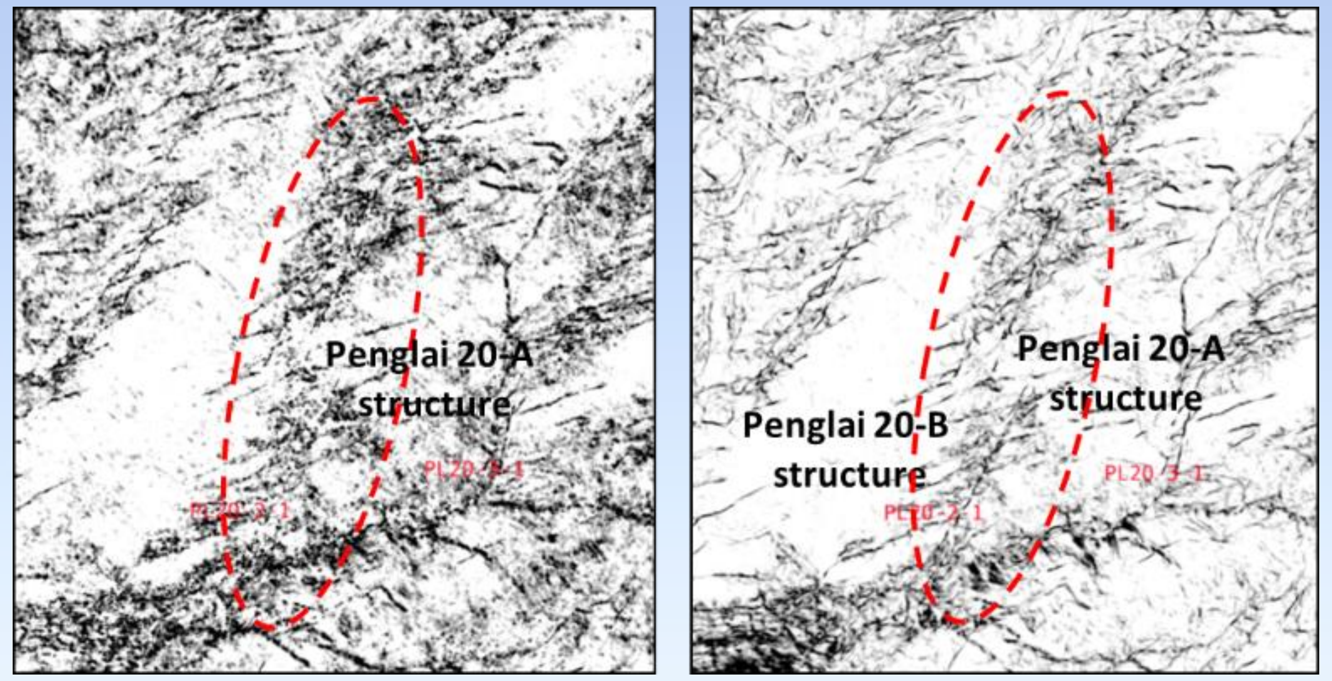

Figure 4. Comparison of identification attributes of different faults

## 2.1 Practical application (Miaoxinan uplift )

Using this technique, a subtle strike-slip fault was identified in the low part of Penglai 20-A structure, and the Penglai 20-B structure was found(Figure 5).The PL20-B-1 well drilled in 2015, the total oil reservoir thickness of the well is 51 meters, confirmed the reliability of this subtle strike-slip, but also proved the feasibility of the technology.

In the subsequent drilled of the 5 wells, there were about 35 meters of oil layer for each well found. However, there was a contradiction with the high-site PL20-B-2 well and the low-site PL20-B-5. Most of the PL20-B-5 well were oil layers in Guantao formation, while most of the PL20-B-2 well were oil and water layers in the same formation.

Based on the above technology, a subtle strike-slip fault extending about 1km was found, which solved the contradiction between two wells(Figure 4). The subsequent deployment of PL20-B-6 well found 60 meters of oil reservoir, upgraded 6.48 million tons of proven oil reserves(Figure 6).




a.Conventional coherence b. high precision coherence

Figure 5. Comparison of different methods in Penglai 20 area(1000ms)

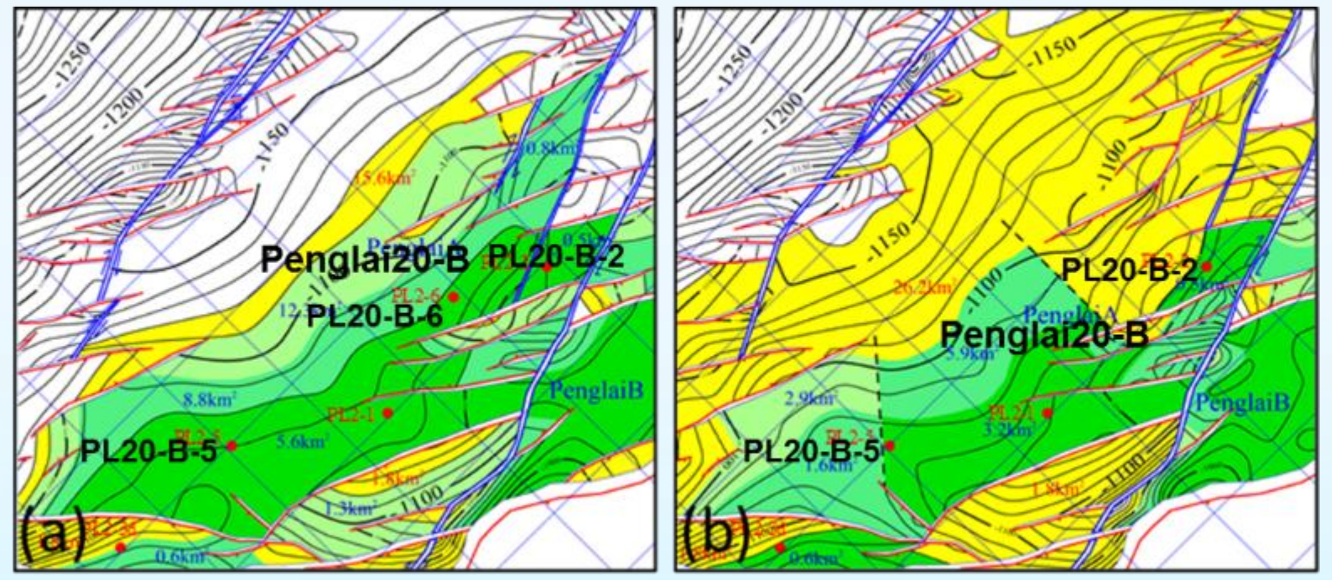



Figure 6. The Guantao formation structural map comparison of new (a) and old (b) in Penglai 20-B Oilfield

## 2.2 Technology extension (Penglai 13-A structure)

In the evaluation process of Penglai 13-A structure in the northern part of the study area, a new subtle strike-slip fault was identified by using the above method, and the 1.3km$^2$ of the trap area was increased, which lays the foundation for the well position deployment in Penglai 13-A structure (Figure 7).

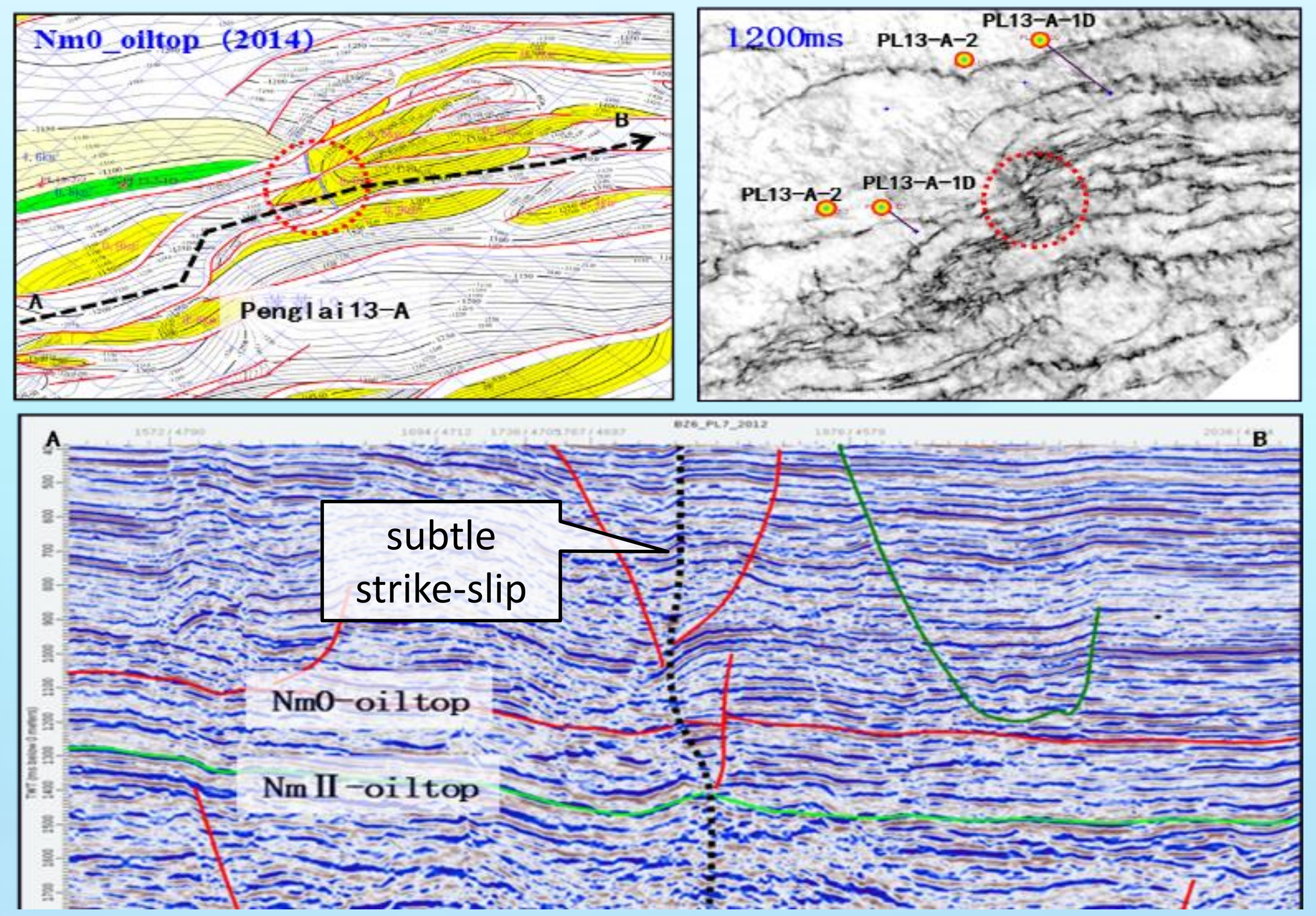



Figure7. Technology application in Penglai 13-A structure

## 3. Conclusion

With the depth of exploration, the larger structural traps are less, but the use of subtle strike- slip fault identification technology can find new structural traps in the development area of the strike- slip fault, which will help the exploration decision. This method has achieved good application effect in the development zones of strike-slip fault in Bohai oilfield, and can be extended to other oilfields with strike-slip fault development.

## 4. Acknowledgements

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