Please fill in the name of the event you are preparing this manuscript for.	International Petroleum Technology Conference 2023 (15th IPTC)
Please fill in your 5-digit IPTC manuscript number.	IPTC-22864-Abstract
Please fill in your manuscript title.	Comprehensive Applications of High-accuracy Fault Prediction in a Complex Structural Belt

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Abstract

Fault interpretation is the basic work of oil and gas exploration, and is becoming more and more accurate with the development of new seismic interpretation technology. However, the fault interpretation is seriously affected by the quality of seismic data, structural complexity, artificial interpretation efficiency and other factors. The faults recognition of conventional seismic data and attribute data is poor, and the efficiency of artificial fault interpretation is low. Therefore, this paper aims to improve the recognition effect of multi-scale and multi-directional faults in complex structural regions, and improve the accuracy and efficiency of fault interpretation based on seismic data.

In this paper, a combined process of high-accuracy fault prediction is established to generate fault data of a fault depression in Bohai Bay Basin. The new methods of AI fault prediction, semi-automatic fault picking and automatic fault interpolation are used to process the post-stack seismic data and well data. The output data of the previous attribute calculation are used as the input data of the next attribute, and the quality control of the key steps is carried out to continuously improve the fault recognition effect of the attribute. On this basis of fault attribute, the fault sticks are automatic interpreted of the fault is completed and the 3D fault modeling is generated for geological analysis.

The calculation size and calculation speed of AI fault prediction are tested by using post-stack seismic data of the fault depression. The AI fault attributes with high resolution, large number of faults and strong contrast are obtained. The number of fault identification is doubled compared with the traditional attributes. After the process of fault enhancement, fault skeleton and Ant attribute operation, the AI-ant attribute is generated. Combining the AI-ant attribute with the seismic data, the semi-automatic fault picking is used to click on both ends of a fault to pick up the whole fault stick(Fig.1). After attribute-based fault interpolation, the fault sticks of all seismic profiles are automatically picked up. The prediction results are consistent with other conventional attributes and well data, and the time spent of automatic fault interpretation is one third of the manual fault interpretation. Finally, the faults geometry of multi-scales and multi-directions is displayed through 3D fault modeling. Under the strike-extensional tectonic movement, ladder-like fault combinations are shown in the profile, and feather-like fault combinations are shown in the horizontal slice. The vertical normal faults are related to the formation of volcanic edifice. The Cenozoic magma expanded horizontally and invaded vertically along the faults.

The technical process proposed in this paper uses conventional post-stack seismic data to predict multi-scale and multi-directional faults, which significantly improves the accuracy and efficiency of fault interpretation in complex structural regions, and provides reliable bases for geological analysis. The application of this high-accuracy fault prediction is also effective in Erdos Basin, Sichuan Basin and other regions.

Keywords: fault prediction; artificial intelligence; fault interpretation

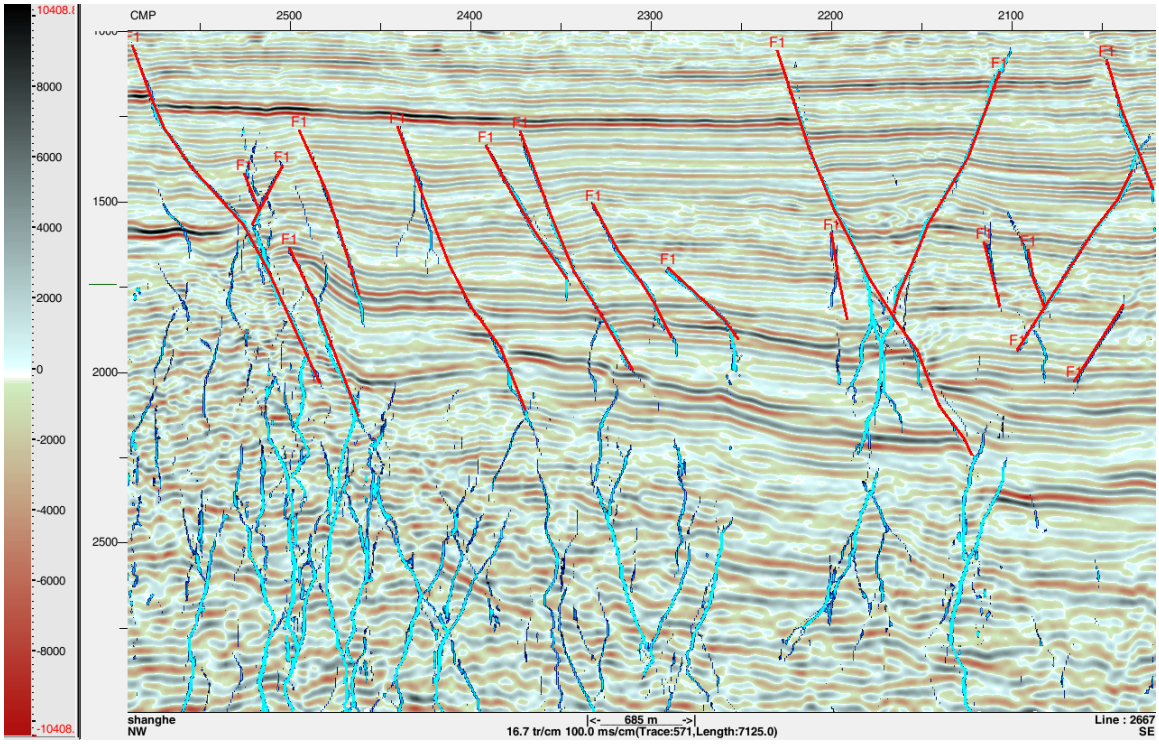

Fig.1 Superimposition display of AI-ant fault attribute, seismic profile and fault sticks