Faults and Hydrocarbons Distribution in the Dongying Sag, East China - Evidence from Structural Interpretation and Multifractal Geometry

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Abstract

Several previous studies have shown that faults have fractal characteristics, and that the fractal dimension of the fault distribution can be used to reflect the fault intensity. The fault intensity and distribution patterns control the number and morphology of hydrocarbons in the study area, and studying the fault fractal geometry can guide the exploration and development of remaining hydrocarbons. In this study, we combined structural interpretation of seismic data with the theory of fractal geometry to obtain a fault density map that could reflect the degree of clustering of fault distribution in the study area. The results show that the most dense fault distribution exists in the Xinzhen structural zone of the Dongying Sag. The fractal dimension of all the Xinzhen area faults is 1.49, and the fault fractal dimensions of the Dongying and Xianhe-zhuang structural zones are 1.47 and 1.38, respectively.

The fault fractal dimension contour map shows that the fault fractal dimension of the Xinzhen structural zone is between 1.4 and 1.6 and the largest area, the fault fractal dimension, has values of 1.2-1.4 in the Dongying structural zone and 1.0-1.2 in the Xianhe-zhuang structural zone. The hydrocarbon distribution area in the Xinzhen structural zone is largest, while that of the Dongying structural zone is smaller than that of the Xinzhen structural zone, and that of the Xianhezhuang structural zone is the smallest. The areas containing hydrocarbons in all three structural zones are located in the region of high fault fractal dimensions. Therefore, the combination of structural interpretation and fractal calculation of the fault plane distributions in the study area can predict the continuous distribution of faults and hydrocarbons.