

Predicting effective hydrocarbon source rocks and resource potential using 3D geological modeling in the lacustrine basin

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The lacustrine basins of eastern China have been proven to contain significant hydrocarbon resources. However, with the depletion of conventional hydrocarbon resources, unconventional oil and gas reservoirs, such as in-source lithologic reservoirs and frackable shale reservoirs, are becoming a focus for explorers. Successfully locating them requires accurately determining the spatial distribution of the effective source rocks with strong heterogeneity. This paper proposed a 3D geological modeling approach that combines geophysical techniques, geological theory and geochemical data to finely describe effective source rocks and quantify hydrocarbon resources potential. The main steps include: (1) mudstone classification; (2) geochemical data analysis; (3) building predictive models; (4) constructing 3D geological models; (5) scanning effective source rocks; and (6) basin simulation. Based on this method, this study systematically evaluated the effective hydrocarbon source rocks of the Fushan Depression, South China Sea. A total volume of 390.91 km³ effective source rocks are estimated to be present in the Fushan Depression. The conventional and unconventional resources amount to 8870.76 megatons and 107.42 megatons, respectively. These results have great implications for locating the favorable exploration areas and will increase exploration success rates. It is a novel and practical method with wide general applicability for effective source rock surveys and resource potential estimations in lacustrine basins.