

## Shale Gas Accumulation of Over-Mature Cambrian Niutitang Formation Shale in Structure-Complicated Area, Southeastern Margin of Upper Yangtze, China

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**Abstract :** The Lower Cambrian Niutitang Formation shale (NFS) deposited in the marine deep-shelf environment in Southeast Upper Yangtze (SUY), possess excellent source rock basis for shale gas generation, however, it is currently challenged by being over-mature with strong tectonic deformations, leading to much uncertainty of gas-bearing potential. With emphasis on the shale gas enrichment of the NFS, analyses were made based on the regional gas-bearing differences obtained from field gas-desorption testing of 18 geological survey wells across the study area. Results show that the NFS bears low gas content of 0.2-2.5 m<sup>3</sup>/t, and the eastern region of SUY is higher than the western region in gas content. Moreover, the methane fraction also presents the similar regional differentiation with the western region less than 10 vol.% while the eastern region generally more than 70 vol.%. Through the analysis of geological theory, the following conclusions are drawn: Depositional environment determines the gas-enriching zones. In the western region, the Dengying Formation underlying the NFS in unconformity contact was mainly plateau facies dolomite with caves and thereby bears poor gas-sealing ability. Whereas the Laobao Formation underlying the NFS in eastern region was a set of siliceous rocks of shelf-slope facies, which can effectively prevent the shale gas from escaping away from the NFS. The tectonic conditions control the gas-enriching bands in the SUY, which is located in the fold zones formed by the thrust of the Southern China plate towards to the Sichuan Basin. Compared with the western region located in the trough-like folds, the eastern region at the fold-thrust belts was uplifted early and deformed weakly, resulting in the relatively less mature level and relatively slight tectonic deformation of the NFS. Faults determine whether shale gas can be accumulated in large scale. Four deep and large normal faults in the study area cut through the Niutitang Formation to the Sinian strata, directly causing a large spillover of natural gas in the adjacent areas. For the secondary faults developed within the shale formation, the reverse faults generally have a positive influence on the shale accumulation while the normal faults perform the opposite influence. Overall, shale gas enrichment targets of the NFS, are the areas with certain thickness of siliceous rocks at the basement of the Niutitang Formation, and near the margin of the paleouplift with less developed faults. These findings provide direction for shale gas exploration in South China, and also provide references for the areas with similar geological conditions all over the world.

**Keywords :** over-mature marine shale, shale gas accumulation, structure-complicated area, Southeast Upper Yangtze

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