

## Sedimentary Environment Analysis of Mesozoic in Southern East China Sea



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Citation: Wang et al., 2019. Sedimentary Environment Analysis of Mesozoic in Southern East China Sea. *Acta Geologica Sinica* (English Edition), 93(supp.2): 317–318.

**Abstracts:** A Southern East China Sea and its adjacent areas are located in the southeastern margin of Eurasian Plate, which consists of the southern part of the East China Sea Shelf basin and the land area of the Zhejiang-Fujian Uplift. Among them, the Mesozoic basins in southern East China Sea are depression basins (Yang et al., 2012), which are composed of Oujiang Sag, Yandang Low Uplift, Minjiang Sag, Taibei Low Uplift and Keelung Sag. They are NE–NNE oriented. The Zhejiang-Fujian Uplift mainly includes the coastal areas of Fujian, Guangdong and Zhejiang, which consists of a series of small faulted basins (Li et al., 2012), such as Yongtai Basin, Julan Basin, Shipu Basin in Xiangshan, etc., The Mesozoic in Zhejiang and Fujian Province was subducted by the Pacific Plate and Philippine Plate. Its structural movement and volcanic activity were intense, and a series of Mesozoic fault basins were developed. These basins are developed on the basis of uplift and have the characteristics of many basins, small area and thin thickness. Among them, Julan Basin is located in the northwest of Fujian Province with an area of about 150 km<sup>2</sup>. A large amount of asphalt was found in 1960s, and drilling was carried out in 1970s. Oil-gas shows were found in more than 10 wells. It is the only basin to drill oil and gas in the Zhejiang-Fujian Uplift area. Julan Basin experienced fault depression in the early Yanshanian period and volcanic eruption in the late Yanshanian period. Sedimentary strata include Lower Jurassic Lishan Formation (J<sub>1</sub>l), Middle Jurassic Zhangping Formation (J<sub>2</sub>zh), Upper Jurassic Douling Group (J<sub>3</sub>dl), Lower Cretaceous Bantou Formation (K<sub>1</sub>b) and Shimaoshan Group (K<sub>1</sub>s). Oil and gas are mainly produced in Bantou Formation. Among them: Lishan Formation is coal-bearing clastic rock deposits of lacustrine facies and floodplain facies; Zhangping Formation is a set of variegated clastic rock deposits of fluvial facies, which is in disconformity contact with the underlying Lishan Formation; Douling Group is a complex continental volcanic clastic rock series, which is in angular unconformity contact with underlying strata; Bantou Formation is the main source rock and oil-bearing rock series in Julan Basin, which develops river-lake sedimentary systems. Based on the comprehensive analysis of the limestone in the Shipu Basin, Xiangshan, it is considered that the Jurassic Shipu limestone is marine-continental transitional facies or marine facies. Comprehensive analysis shows that the Jurassic stratigraphic

sedimentary facies in the continental area eastward transited from continental facies in Julan Basin to marine-continental transitional facies or marine facies, which has a certain hydrocarbon generation potential (Duan, 2013). At present, the Mesozoic strata in the sea area have been exposed more. Five wells have drilled into the Mesozoic strata in southern East China Sea. The Mesozoic strata exposed in FZ10-1-1 and FZ13-2-1 wells are relatively complete. They not only drilled through the Cretaceous strata, but also drilled into thicker Jurassic strata (Jiang, 2003). Jurassic strata mainly include Fuzhou Formation and Xiamen Formation. Fuzhou Formation in FZ10-1-1 well (583.5 meters thick, no bottom) is a set of dark clastic rocks with several layers of thin coal seams or carbonaceous mudstone. Lithological characteristics are as follows: the upper part is gray-white sandstone, brown and tan mudstone, light gray and gray mudstone in different thickness, which contain marine fossils, and they are littoral-shallow marine deposits. The lower part is the interbedding of grey, dark grey mudstone and grayish-white sandstone with several thin coal seams, and the near bottom is thick layered sandstone with thin mudstone. Jiang Zaixing et al. (2012) made a detailed description and microscopic identification of the core of Fuzhou Formation in FZ10-1-1 well. It was found that the lithology of this formation is a set of grey-black mudstone and silty mudstone. Horizontal bedding is well developed, and local strata are the rhythmic beds of clayish laminae and calcareous laminae. Shallow marine fossils were found in Fuzhou Formation. Combining with regional geological characteristics, we consider that Fuzhou Formation is littoral-shallow marine facies or marine-continental transitional facies (Wang et al., 2000). Seismic reflection characteristics of Mesozoic strata are obvious in the study area, in which deep-sea facies strata show medium-strong amplitude continuous sheet shape, while continental delta facies strata show weak amplitude with continuous wedge shape. The reflection characteristics of Oujiang Sag in the western part of the basin are wedge-shaped facies and filling facies with variable amplitude and continuous-discontinuous, while the reflection characteristics of Minjiang Sag and Keelung Sag in the eastern part are mainly sheet-shaped facies with medium-strong amplitude and continuous-discontinuous (Hu et al., 2012). Comprehensive analysis shows that shallow sea facies and marine-continental transitional facies are mainly developed in Jurassic in the sea area. Sedimentary environment determines the distribution and potential of source

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rocks. As mentioned above, the early Jurassic (Lishan Formation J1l) of Julan Basin in the continental area is a set of coal-bearing rock series. The total organic carbon of dark mudstone is 0.46%–0.70%, and the content of chloroform asphalt “A” is 0.026–0.073, which belongs to poor-non-hydrocarbon source rock. The Early–Middle Jurassic in the sea area is a set of coal-bearing rock series of marine–continental transitional. Which has a total organic carbon of dark mudstone of 1.17%, Chloroform asphalt “A” content of 0.862 and total hydrocarbon content of 345. The kerogen type is mainly type II–III, which belongs to better hydrocarbon source rocks (Gong et al., 2012; Gong et al., 2013). The Mesozoic volcanic activity in the continental area is intense. Most Jurassic source rocks are in the stage of high maturity to over maturity, while the volcanic activity in the sea area is relatively weak. The source rocks of Fuzhou Formation are of moderate maturity and have good conditions of generation and preservation. Regional tectonic analysis shows that most of the Mesozoic basins in the continental area are small faulted basins with continental sedimentary strata and intense tectonic movements (Wang et al., 2013), which are not conducive to the generation and preservation of large-scale oil-gas (Yang et al., 2011). The Mesozoic basin in the sea area is a depression basin. The Mesozoic developed a set of stable deep-water sedimentary strata under the background of stable subsidence, and the volcanic activity was weak (Yang et al., 2012), which is conducive to hydrocarbon generation. The analysis of sedimentary environment shows that the Jurassic in the continental area mainly develops fluvial facies and lacustrine facies. The Jurassic in the sea area mainly develops marine–continental transitional facies and marine facies, and its hydrocarbon generation potential and reservoir property are obviously better than continental strata. In view of the discovery of oil-gas in the Mesozoic strata of Julan Basin, it is presumed that the Jurassic strata in the sea area have good prospects of petroleum exploration.

**Key words:** southern East China Sea, Mesozoic, Jurassic, sedimentary environment, oil and gas exploration potential

**Acknowledgments:** This work is granted by the National Natural Science Foundation of China (Grant No. 41476053) and the China Geological Survey Project (Grant Nos. DD20160153 and DD20190211).

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