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Geochemical Characteristics and Possible Origin of Natural Gas in the Qiongdongnan Basin, South China Sea

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The Qiongdongnan basin is located in the north continental shell of the South China Sea. It is separated into three tectonic units- North uplift, Centre depression and South uplift, by the No.2 fault and No.11 fault. In recent years, this basin has drawn great attention for its large sedimentary volumes and gas potentials. After 30 years exploration and development, only YC13-1 gas field and many gas-bearing structures have been discovered.

Many geochemical researches had been carried out in the basin, with the focus on the general characteristics of the natural gases and their possible source rocks. These studies indicated that potential source rocks of the YC13-1 gas field included the marine shales in the Meishan Formation of the Yinggehai basin and the coal-bearing Oligocene (Yacheng and Linshui Formation) of the Qiongdongnan basin. And the basin generally contains three types of natural gas, which are biogas and bio-low mature transitional zone gas, thermogenic normal mature gas and high heat over-mature gas (forecast).

In this paper, the gas compositions, contents of light hydrocarbons and stable carbon isotope ratios have been used for the investigation of natural gas origins and their source rocks in Qiongdongnan basin, South China Sea. The result shows that Non-hydrocarbon gas, mostly being CO₂ and N₂, is rich in the eastern area of the basin. Hydrocarbon gas content is high and drier in the western area of the basin, but varies and lower moisture in the eastern area of the basin. Shallow formation with the low mature to mature biogenic gases mainly distribute at the shallow depth, except of the eastern area nearing the Baodao sag with high maturity of the humic coal-type gas. The western basin with mature ~ high mature mixture petroliferous gas, and some structural belt on the Yacheng prominence with low mature~mature coal-type gas. The distribution of plot of $\delta^{13}\text{C}_2$ - $\delta^{13}\text{C}_3$ and $\ln(\text{C}_2/\text{C}_3)$ illustrates that most gases belongs to cracking of kerogen, few of them to cracking of oil. It is, therefore, postulated the kerogen cracking gases possibly derived from the mature ~ high mature Oligocene (Yacheng Formation and Lingshui Formation) coastal coal measures and mudstones, and the oil cracking gases mainly from the Eocene deep lacustrine mudstones.