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Origins and Deep Water Exploration Potential of Natural Gases in the Offshore South China Sea

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Abstract

More than ten gas pools in the shallow water region of the Pearl River Mouth (PRM) Basin and the Qiongdongnan (QDN) Basin, the Offshore South China Sea have been discovered since 1983. Gases produced from QDN Basin are characterized by high contents of benzene and toluene and relatively heavy delta13C2 values (-25- -27 permil), and the associated condensates by high abundance of bicadinanes and oleanane, which indicate a good correlation with the coal-bearing sequence of the Oligocene Yacheng Formation in the Basin. In contrast, the gases from PRM Basin contain lower amounts of benzene and toluene, lighter delta13C2 values(-24- -34 permil), and a widely variable concentration of bicadinane and oleanane was identified from the associated condensates, which can be largely correlated with the Lower Oligocene Enping Formation source rocks formed in swamp to shallow lake in the Basin. The available geochemical data have indicated that both the Yacheng Formation and the Enping Formation from the basins contain mainly type III-II2 kerogen with dominant gas potential. The regional geological background indicates that the deep water regions of the two basins share the same hydrocarbon source sags with the shallow-water areas, and developed massive sandstone reservoirs during Oligocene and Miocene. Fluid flowing modeling results show that the deep water regions were on the pathway of lateral migrating gases, implicating to be favorable habitats for gas accumulation. In addition, the reservoirs in the zones have developed abundant bright spots which may reflect the presence of gas. Therefore, it is believed that there are great gas exploration potentials in the deepwater regions of the Offshore South China Sea, and the combination of geochemical data with basin modeling results will help to better define favourable targeting areas and reduce risk associated with the future deepwater exploration in the basins.