

Petroleum Systems in the Jinhu Depression: Derivation of “Immature Oils” from Mature Source Rocks

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The Jinhu Depression of the North Jiangsu-South Yellow Sea Basin in eastern China was considered to be a suitable habitat for the formation of “immature oil”. This study characterized the detailed chemical compositions of crude oils and the potential source rock extracts in the Jinhu Depression in order to understand their genetic relationship. The oil samples were collected from the major producing fields in the Western Slope and the Biandong-Yangjiaba-Minqiao uplift belt. The source rock samples were selected after Rock-Eval pyrolysis screening of a large suite of samples and consist of shales in the Paleocene Funing Formation from the oilfield areas and the Sanhe sag all within the Jinhu Depression.

Geochemical characteristics indicate only one single family of oils. A number of biomarker features support deposition of the source rocks for these oils under conditions of enhanced salinity/stratified water columns. A wide thermal maturity range for the oils as indicated by sterane isomerization ratios was not substantiated by other maturity parameters. The genetic relationships between the oils and the E₂f₂ member of the Paleocene Funing Formation present in the deeper parts of the Sanhe and Longgang sags were suggested using a wide range of molecular parameters. Variation in the sterane concentrations in source rocks with different maturity suggests that migrational contamination and/or in-situ extractions of organic matter from caprocks or intra-reservoir shales by mature oils could potentially produce oils with apparent immaturity at molecular level, thus the “immature oils” were most likely derived dominantly from the deep, mature source. Secondary alteration (e.g. biodegradation) of oils in shallow reservoirs could also have had adverse effect on bulk oil compositions. Although we do not discount the possible presence of minor amounts of “immature oils” derived from truly immature source, exploration in the Jinhu Depression as well as many other rift basins in eastern China should be focused on mature oils derived from the deep source kitchens.