Research on the symbiotic relationship between river-delta depositional system and source rocks: An example from North Carnarvon Basin, North West Shelf, Australia

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The target of this paper is studying "the symbiosis model of the different river-delta depositional system and source rocks and predicting the distribution of high quality source rock" by taking North Carnarvon Basin in the northwest shelf of Australia as the example. After a comprehensive study on the basis of tectonic evolution, sedimentary evolution characteristics and source rock characteristics in the Mesozoic of North Carnarvon Basin shows that the basin separately developed five sets of source rock being related with the river-delta depositional system. The quality and scale of the source rock development are controlled by the different tectonic evolution stages with its corresponding river-delta depositional system. The continental-facies source rock which mainly formed in pre-rift stage mainly develops in Late Triassic of North Carnarvon Basin. The formation of source rock type above relates to the large delta input: The delta plain sedimentary environment mainly forms coal measure strata which has large thickness and high organic carbon abundance. The coal measure strata whose source rock type are III type and II_2 type and total organic carbon is from 1.5% to 6.5% is the most important Gas-type source rock in this area. The marine-facies source rock which mainly formed in the continental break-up stage develops in Late Jurassic of North Carnarvon Basin. The formation of this source rock type is influenced by small river-delta and restricted sea depositional system which have lung and concave ancient landform pattern. This sedimentary environment has a relatively closed and quite water body environment which is also favorable to the enrichment and conservation of source rocks. This source rock type is II_1 type and total organic carbon is from 1% to 3% is the most important Oil-type source rock in this area. At the end, according to above research results we establish the symbiosis model of river-delta sedimentary and source rocks in three different models including fluvial-dominated delta plain coal-measure source rock model, delta type's prodelta- continental shelf source rock model and small delta and restricted sea model source rock model. At the same time we further definite the distribution of high quality source rock in different models.