

FACTORS CONTROLLING THE DIFFERENCE BETWEEN OIL AND GAS DISTRIBUTION IN ADJACENT ZENGMU AND BARAM-SABAH BASINS

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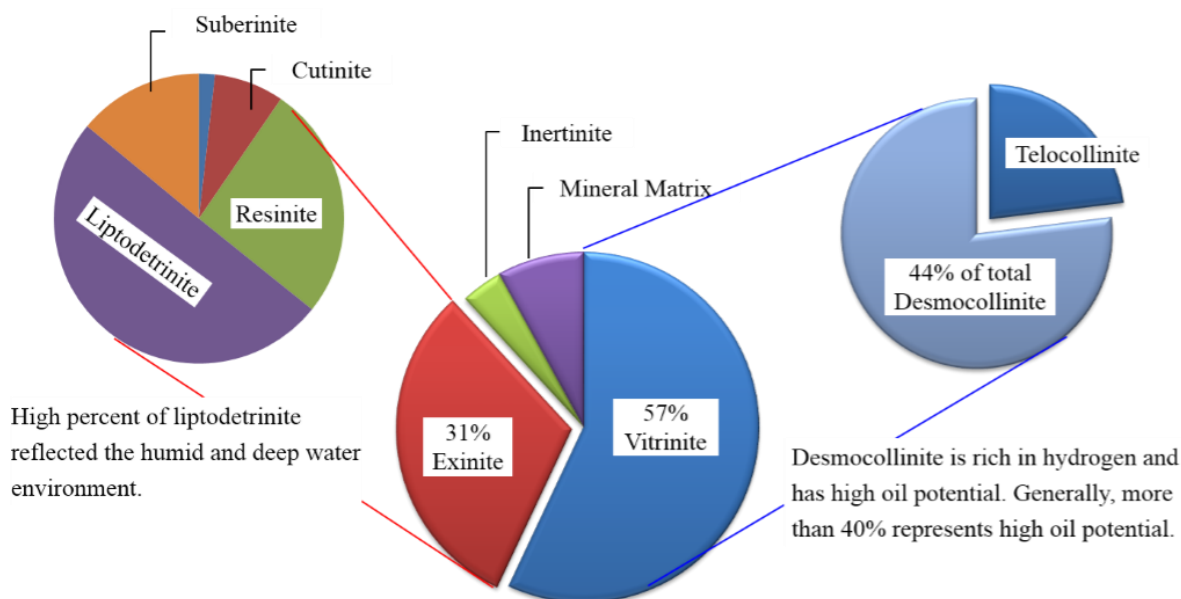
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INTRODUCTION AND METHODS

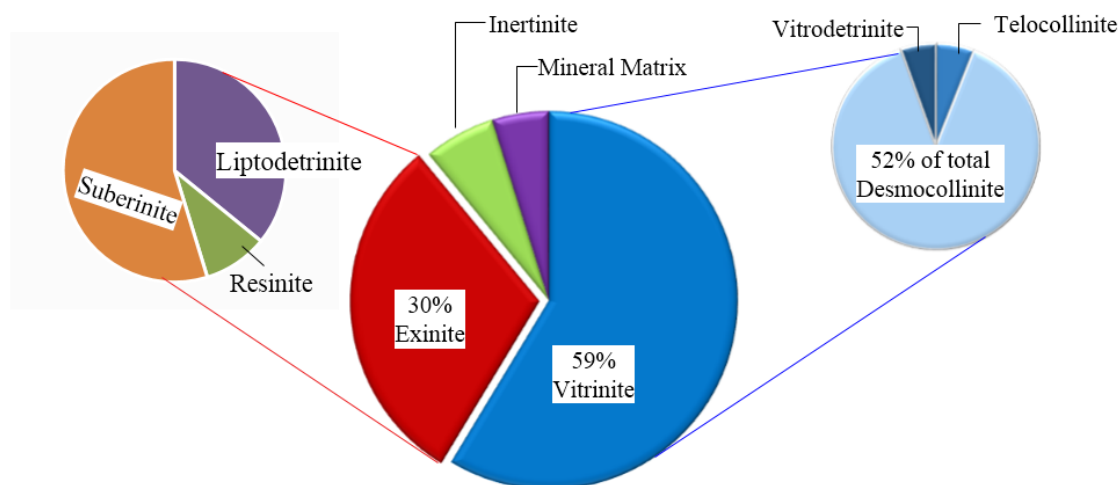
Two adjacent basins, Zengmu and Baram-Sabah, located in the South of the South China Sea, with area of $17 \times 10^4 \text{ km}^2$ and $9.4 \times 10^4 \text{ km}^2$ respectively, have equivalent recoverable reserves. However, Zengmu basin is dominated by gas while Baram-Sabah basin is dominated by oil. The analysis based on the combination of geochemistry and sedimentology has been conducted in order to explain the significant heterogeneity of oil and gas distribution in two adjacent basins.

RESEULTS

1. Phlobaphinite(a type of collinite) derived from mangrove is generally detected in the coal samples from the Zengmu and Baram-Sabah basins. The distribution of lowland peats is similar to that of the mangrove sediments in Kalimantan region at Miocene, also indicating that the mangrove is the major source of coal. According to the study on the maceral composition of modern mangrove, it is dominated by vitrinite and also contains abundant liptinite. The desmocollinite and corpocillinite are the predominant composition in the vitrinite group, and they are relatively enriched in hydrogen, suggesting that the mangrove has a higher oil generation potential than other terrestrial high plants. Hydrogen-rich organic matter (i.e., mangrove) caused the high generation potential of petroleum in both basins.
2. Sedimentary environment and hydrodynamic condition control the nature of the source rocks in two basins. In Zengmu Basin, the fluvial-dominated channel facies association, revealed by the sedimentary sequence study on the Nyalau Formation(Late Oligocene-Early Miocene clastic coastal plain to coastal deposits) in the Balingian Province supports the development of river-dominated delta, which is beneficial for in-situ coal deposition. However, in Baram-Sabah basin, hummocky stratification and bioturbation are generally found in the Upper-Middle Miocene sediments, indicating a strong hydrodynamic condition. Thus the delta is dominated by wave and is destructive, which is against to the in-situ coal deposition. The wave-dominated delta can move the formed in-situ coal for a short journey and break the larger particles of organic matter into smaller particles, which is consistent with the presence of no/little coal seam. The hydrogen-rich materials were deposited as the form of carbonaceous mudstone along the caost. Thus , in Baram-Sabah basin,hydrogen-rich carbonaceous mudstone might be the major source rocks, not coal.
3. Sedimentary facies controlled the oil and gas distribution. Delta was widely developed in the Oligocene-early Miocene sediments in Balingian province of Zengmu basin and in the middle-late Miocene sediments in Baram-Sabah basin. Hydrogen-rich organic matter was enriched in coal seam and carboneous mudstone. Therefore, the oil were dominated. The minor content of hydrogen-rich terristral organic matter, which did not enriched in delta, was transported into neritic-bathyal facies in Luconia platform of Zengmu basin and absorbed in mudstone, which made the predominant gas potential in this region.



(a) Balingian coal sample, Zengmu basin



(b) Baram drift coal sample

Figure 1 an average maceral component of Low Miocene coal source rock in Balingian, Zengmu basin and drift coal in Baram

- [1] Hassan M H A, Johnson H D, Allison P A, et al. Sedimentology and stratigraphic development of the upper Nyalau Formation (Early Miocene), Sarawak, Malaysia: A mixed wave- and tide-influenced coastal system [J]. *Journal of Asian Earth Sciences*, 2013, 76(1):301-311.
- [2] H.D.Johnson, T.Kuud and A.Dundang. 1989. Sedimentology and reservoir geology of the Betty field, Baram Delta Province, offshore Sarawak, NW Borneo. *Geol. Soc. Malaysia, Bulletin* 25,pp.119-161
- [3] S.T.Sandal. The Geology and Hydrocarbon Resources of Negara Brunei Darussal[M]. Muzium Brunei, 1996.
- [4] Sia S G, Wan H A, Konjing Z, et al. The age, palaeoclimate, palaeovegetation, coal seam architecture/mire types, paleodepositional environments and thermal maturity of syn-collision paralic coal from Mukah, Sarawak, Malaysia [J]. *Journal of Asian Earth Sciences*, 2014, 81(4):1-19.