

# Source Rock Pyrolysis and Thermal Maturity of Early-Late Miocene Syn-Rift Deposits in Southeastern Sabah, Malaysia

NUR AMALINA AHMAD THANA'ANI\*, KHAIRUL AZLAN MUSTAPHA & MOHAMMED IDRIS

Department of Geology, Faculty of Science, University of Malaya, 50603 Kuala Lumpur, Malaysia

The onshore SE Sabah Basin that is extended from northern part of hydrocarbon prolific Tarakan Basin in Kalimantan are of interest in this study. This basin was filled by thick Miocene sediments, deposited in deltaic-shallow marine environment and comprised of Kalabakan, Tanjong and Kapilit formation sedimentary sequences. A total of thirty-one outcrop samples derived from these sequences were collected and subjected to Rock-Eval pyrolysis and vitrinite reflectance analysis to evaluate hydrocarbon generating potential and determine thermal maturity stage of the source rock. The collected rock samples were mainly fine-grained siliciclastic rocks and coals. Rock-eval pyrolysis indicates TOC content vary with lithology. Kapilit and Tanjong formations are dominated by coal, thus possessing very high TOC content (60.69-81.97 wt.% and 66.08-92.96 wt.%, respectively). The Kalabakan Formation which was dominated by black shales however have lower TOC content ranging between 0.50 wt.% to 1.82 wt.%. This indicates Kapilit and Tanjong formations samples have excellent source rock potential whilst Kalabakan formation have fair to good source rock potential. Pyrolysis S<sub>2</sub> data indicates similar trend of TOC contents as shown in figure 1. The Hydrogen Index (HI) of Kapilit and Tanjong samples are in the range between 424 to 768 mgHC/gRock and 157 to 367 mgHC/gRock respectively, thus indicate the kerogens are dominated by Type II/III and capable to generate oil and gas (Fig. 2). Kalabakan samples however have lower HI values ranging from 14 to 110 mgHC/gRock, thus indicate Type III/IV kerogen and is capable to generate gas (Fig. 2). The analysed samples are varied in maturity stage as indicated by vitrinite reflectance (VR) measurements and Tmax. The analysed Kapilit

Formation samples are thermally immature to early mature as indicated by VR values ranging from 0.43% R<sub>o</sub> to 0.70% R<sub>o</sub>. Tanjong Formation samples are interpreted to be mature to peak oil generation (0.60% R<sub>o</sub> to 1.08% R<sub>o</sub>) whilst Kalabakan Formation samples are post-mature and have entered gas window (1.06% R<sub>o</sub> to 1.55% R<sub>o</sub>). Vitrinite reflectance measurements are in good agreement with Tmax data (Fig. 3).

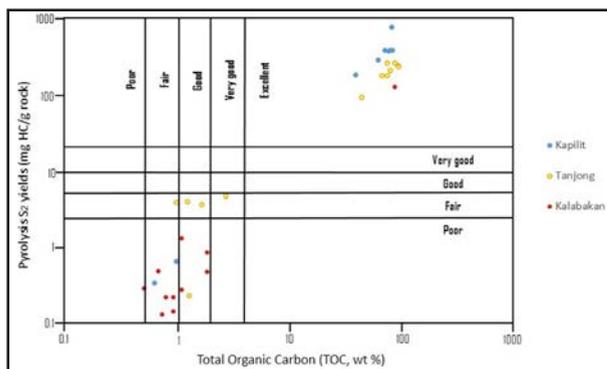


Figure 1. Cross-plot of pyrolysis S<sub>2</sub> yields versus Total Organic carbon (TOC) shows variation of source rock quality in the analysed samples.

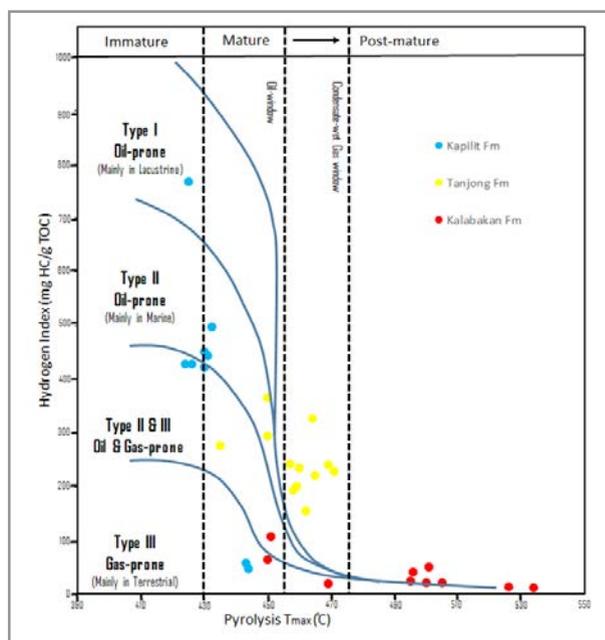


Figure 2. Kerogen type discrimination diagram of Hydrogen Index (HI) versus Pyrolysis Tmax.

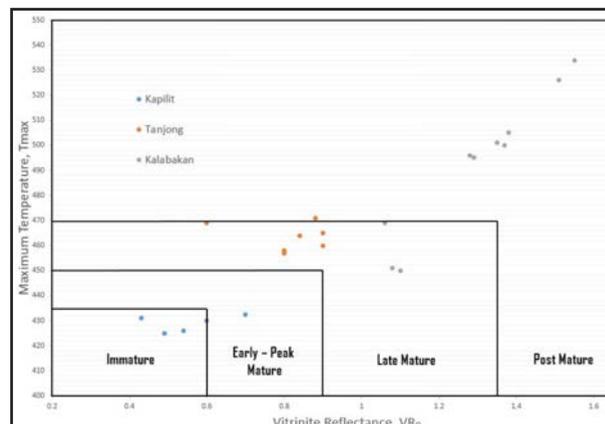


Figure 3. Cross-plot of Maximum Temperature (Tmax) versus Vitrinite Reflectance (VR<sub>o</sub>) shows variation of thermal maturity in the analysed samples.