

Trends in organic matter distribution and characteristics among rock formations in Peninsular Malaysia: Implications on hydrocarbon generation potential

Alidu Rashid, Numair Ahmed Siddiqui

Department of Geoscience, Universiti Teknologi PETRONAS, Malaysia

Summary

The presence of organic matter is a crucial factor in the hydrocarbon generation process; without organic matter, hydrocarbons cannot be generated. As a result, examining the characteristics of organic matter has become an essential part of source rock evaluation. This study analyzes organic matter's richness, quality, and thermal maturity in several rock formations in Peninsular Malaysia. Formations such as Belata, Semantan, Semanggol, Kroh, Penyu, Batu Gajah, and Batu Arang were analyzed for their organic matter characteristics and distribution. Overall, the richness of formations is very good, with TOC ranging from 1.33 % to 41.23 %. The Batu Arang and Penyu formations have the highest TOC values. The Penyu and Batu Arang formations indicated type II and type III kerogens, while the others suggested type III and IV kerogens. The Belata and Kroh formations have significantly matured organic matter. The Belata and Kroh formations have already generated gas, while Penyu and Batu Arang formations are the least mature, with some organic matter yet to generate anything. Most of these formations are in the western belt of Peninsular Malaysia except for the Penyu basin in the central belt. The differences in organic matter characteristics could be attributed to depositional environments and characteristics of the rock itself. The Penyu and Batu Arang formations have the highest potential to generate hydrocarbons, while the Kroh and the Belata formations have the slightest chance of generating hydrocarbons.

Method

Seven (7) formations from Peninsular Malaysia were analyzed for their organic geochemical characteristics. Published data of several authors on TOC analysis, Rock-Eval Pyrolysis, and Vitrinite Reflectance analysis were accumulated and analyzed to determine the organic matter characteristics of these formations in Peninsular Malaysia. Some of the values, such as Vitrinite Reflectance (R_o), which are not in some of the data obtained, were calculated using the formula $R_o = (0.0149 \times T_{max}) - 5.85$ according to (Wust et al., 2013). Other values used in the analysis were also calculated using their well-known formulas.

Results, Observations, Conclusions

Due to the high TOC values, the Penyu and Batu Arang formations have the highest chance of generating hydrocarbons from all the formations studied in Peninsular Malaysia. Thermal maturity plots also indicate the immature nature of the organic matter in the Penyu and Batu Arang formations. These formations will also generate type I and II kerogens, mainly waxy and naphthenic oil. The Semantan and Semanggol formations have a meager chance of generating hydrocarbons compared to the Penyu and Batu Arang formations. The Semantan and Semanggol formations have good TOC; however, the formations have matured organic matter, indicating that most hydrocarbons have already been generated. The Kroh, Belata, and Batu Gajah formations have the slightest chance of generating hydrocarbons because of the highly mature nature of the organic matter of Kroh and Belata formations. The Batu Gajah formation has only TOC data; however, only TOC cannot be used to determine the true potential of this formation to generate hydrocarbons.

The immature Penyu and Batu Arang formations have not been buried sufficiently for hydrocarbon generation, but the stratigraphic equivalent of these sediments offshore are buried to a deeper depth and could therefore be matured enough to generate hydrocarbons because maturity increases with burial depth due to higher temperatures that prevail in deeper parts of the earth's crust

Novel/Additive Information

This research gives new insight into the organic matter characteristics of several formations in Peninsular Malaysia and their prospects and challenges in generating hydrocarbons.

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References

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