

Organic Geochemical Evaluation of the Eccca Group Shale: Implications for Hydrocarbon Potential

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Abstract : Shale gas has recently been the exploration focus for future energy resource in South Africa. Specifically, the black shales of the lower Eccca Group in the study area are considered to be one of the most prospective targets for shale gas exploration. Evaluation of this potential resource has been restricted due to the lack of exploration and scarcity of existing drill core data. Thus, only limited previous geochemical data exist for these formations. In this study, outcrop and core samples of the Eccca Group were analysed to assess their total organic carbon (TOC), organic matter type, thermal maturity and hydrocarbon generation potential (SP). The results show that these rocks have TOC ranging from 0.11 to 7.35 wt.%. The SP values vary from 0.09 to 0.53 mg HC/g, suggesting poor hydrocarbon generative potential. The plot of S1 versus TOC shows that the source rocks were characterized by autochthonous hydrocarbons. S2/S3 values range between 0.40 and 7.5, indicating Type- II/III, III, and IV kerogen. With the exception of one sample from the collingham formation which has HI value of 53 mg HC/g TOC, all other samples have HI values of less than 50 mg HC/g TOC, thus suggesting Type-IV kerogen, which is mostly derived from reworked organic matter (mainly dead carbon) with little or no potential for hydrocarbon generation. Tmax values range from 318 to 601°C, indicating immature to over-maturity of hydrocarbon. The vitrinite reflectance values range from 2.22 to 3.93%, indicating over-maturity of the kerogen. Binary plots of HI against OI and HI versus Tmax show that the shales are of Type II and mixed Type II-III kerogen, which are capable of generating both natural gas and minor oil at suitable burial depth. Based on the geochemical data, it can be inferred that the source rocks are immature to over-matured variable from localities and have potential of producing wet to dry gas at present-stage. Generally, the Whitehill formation of the Eccca Group is comparable to the Marcellus and Barnett Shales. This further supports the assumption that the Whitehill Formation has a high probability of being a profitable shale gas play, but only when explored in dolerite-free area and away from the Cape Fold Belt.

Keywords : source rock, organic matter type, thermal maturity, hydrocarbon generation potential, Eccca Group

Conference Title : ICCMGS 2019 : International Conference on Carbon Materials and Geological Sciences

Conference Location : Amsterdam, Netherlands

Conference Dates : February 07-08, 2019