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Molecular organic geochemical evaluation of Cretaceous black shales in Mamfe Basin, Cameroon

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The Mamfe Basin in southwestern Cameroon is an intra-continental basin with shale deposits from the Cretaceous strata that have not been well studied in terms of their palaeo-environmental conditions and hydrocarbon generative potential. The lack of understanding about the organic matter source and thermal maturity prompted a recent study to investigate these aspects.

Field sampling was conducted on road-cuts and river channels, resulting in the collection of sixteen shale samples. Analysis of these samples included measuring total organic carbon content (TOC) and various Rock Eval parameters. Organic petrographic analysis was employed to identify the maceral composition of the organic matter. Seven samples with sufficient TOC were selected for soxhlet extraction and further analysis using column chromatography and gas chromatography techniques to determine the source of organic matter and palaeo-environmental conditions.

Results revealed that the shale's TOC content ranged from 0.17 to 4.53 wt. %, with varied levels of volatile hydrocarbon content (S1) and remaining hydrocarbon generative potential (S2), indicating a range of poor to good source rock generative potential. The hydrogen index (HI) values (10-281 mg HC/TOC) suggested gas-prone organic matter.

Thermal maturity parameters such as Tmax and vitrinite reflectance indicated a range of thermal maturity, with the organic matter being transformed into condensate, wet gas, and dry gas due to post-Cretaceous igneous activities in the basin. Additionally, organic petrography identified vitrinite and inertinite macerals, further supporting the presence of gas-prone organic matter with a terrestrial origin.

Various ratios such as Carbon Preference Index, Pristane/Phytane ratio, Trisnorneohopane/Trisnorhopane, moretane/hopane ratio and sterane abundance ratios indicated that the shales are mature for hydrocarbon generation and predominantly derived from terrestrial plant sources. The Mamfe Basin was determined to have fair hydrocarbon generative potential with a focus on gas-prone organic matter. The study concluded that the shales are thermally mature to post mature, likely influenced by post-Cretaceous igneous activities in the region.