Organic geochemical characteristics and oil generating potential of the lower Napo Formation shale (Cretaceous) in the eastern Oriente Basin, Ecuador

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The Oriente Basin belongs to the large present-day Maranon – Oriente – Putumayo foreland system and oil province known as MOP (Marksteiner & Aleman 1997). The Oriente Basin hosts around 30 billion barrels of oil (BBO) trapped in 100 fields can be considered as one of the most prolific petroleum Sub-Andean basins (Baby et al. 2013). The in situ source rocks of the Oriente Basin are immature or poorly mature (Baby et al. 2013; Dashwood & Abbotts, 1990). This paper focuses on the organic geochemical characteristics and oil generating potential of the Cretaceous Napo Formation shale in the Tarapoa Block. Thirteen shale samples from B limestone and T Members of the lower Napo Formation were collected from two exploration wells in the study area.

Shales microscopy show obvious laminated layers and an abundance of organic matter. Eight shale samples carried out X-Ray Diffraction (XRD) analysis. The organic geochemical result indicates that shales mainly contain clay minerals ranging from 36.0-85.4 wt%. Other compositions of shales include quartz (range 12.7-26.9 wt%), calcite, pyrite and siderite. The clay minerals are mixed-layer illite–smectite (I/S), illite and kaolinite. The smectite ratios in mixed-layer I/S clays are relatively low, ranged from 15 to 30%. The lower Napo shales are the product of phase A of catagenesis stage.

Rock–Eval pyrolysis analysis was performed. Source rock generative potential was evaluated using total organic carbon content (wt% TOC) and pyrolysis S2 yield. The lower Napo shale samples contain rich organic matter and have TOC content of 1.61–5.97 wt %. The amount of hydrocarbon yield (S2) have more than 7.0 mg HC/g rock. Thus, pyrolysis S2 yields indicate that the Napo shale samples are good to very good generative potential. A plot of whole rock hydrogen index (HI) and pyrolysis indicate the organic matters belong to the early mature to mature zone of Type II kerogen.

The thermal maturity of organic matter in the analyzed samples is evaluated based on the T_max of the pyrolysis S2 peak. T_max values range from 436–442 °C. Thus, these shale samples possess early mature to mature zone of Type II kerogen.

References