

Source rock characteristics and basin modelling of the Upper Jurassic Madbi Formation, Masila Basin, Yemen

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The Masila Basin is an important hydrocarbon province in Yemen (Fig.1), however the origin of the hydrocarbons is not fully understood. In this study, we evaluate the Upper Jurassic source rock in the Madbi Formation and assess the results of basin modeling in order to improve our understanding of burial history and hydrocarbon generation. Evaluation of the hydrocarbon source rock potential and oil generation in the central-west of the Masila Basin were based on organic geochemistry (Rock-Eval pyrolysis, TOC and bitumen extraction) and organic petrology studied. Shales in the Upper Jurassic Madbi Formation contain relatively high quantities of organic matter (usually more than 2.0 wt% TOC; Fig.2) and have very good to excellent hydrocarbon potential (Fig.2). The shales predominantly contain algal Type II kerogen with minor Type I kerogen (Fig.3). Thermal maturity of the organic matter is 0.69–0.91% vitrinite reflectance. Thermal and burial history models indicate that the source rock entered the early- mature to mature stage in the Late Cretaceous to Early Tertiary times (Fig.4). Therefore, the hydrocarbon generation from the Madbi source rock occurred in the Late Cretaceous, reaching maximum rates during the Early Tertiary (Fig.4). Cretaceous subsidence had only a minor influence on source rock maturation and organic matter transformation. This source rock has generated commercial volumes of hydrocarbons which migrated into Jurassic and Lower Cretaceous reservoir rocks.



Figure 1: Location map of the study area in the central-west of the Masila Basin, showing locations of the studied wells.

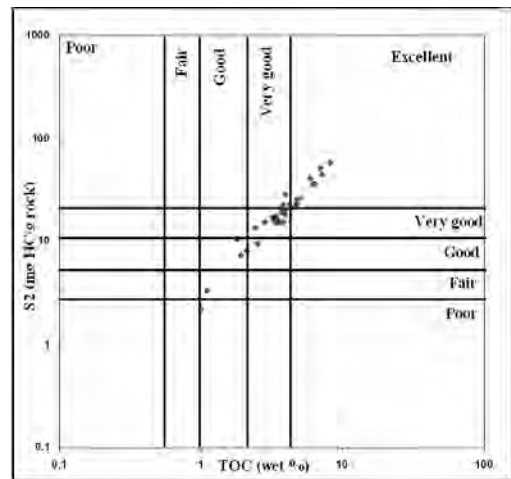


Figure 2: Distribution of shale samples into S2 versus total organic matter (TOC) plot; showing generative source rock potential.

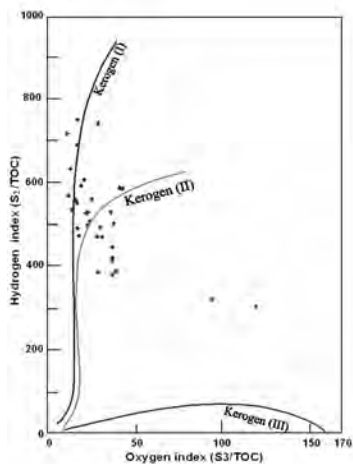


Figure 3: Van Krevelen diagram based on oxygen index (OI) versus hydrogen index (HI), showing the oil prone kerogen type. Most samples plot along Types I and II evolution paths.

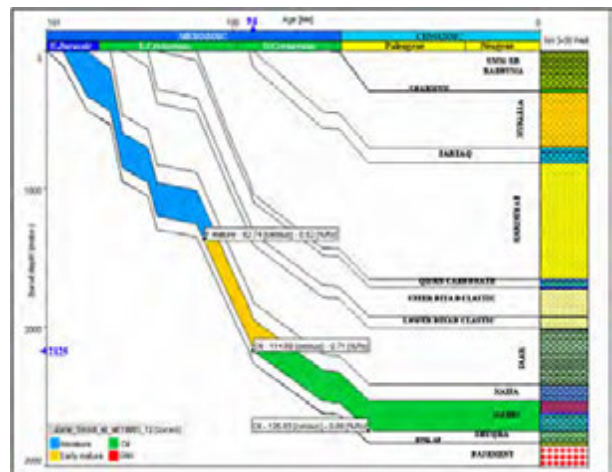


Figure 4: Burial history curves with hydrocarbon zones of Madbi shale in wells KHA 3-08 in the study area.