

Source Potential and Hydrocarbon Maturity Modeling of the Onshore Masila Basin, Eastern Yemen

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The Masila Basin is one of the most hydrocarbon-prolific sedimentary basins in the Republic of Yemen and is located in the Hadramaut region in East Central Yemen (Fig. 1). The hydrocarbons produced from Masila Basin are predominantly oil with minor amounts of natural gas. This basin formed as a rift during the Late Jurassic-Early Cretaceous due to the Gondwana breakup. This paper will present subsidence histories, maturation window, hydrocarbon generation and expulsion analysis. The main points are the vertical extent of strata which can be the source rock for mature hydrocarbon generation and the thermal history of the source rock. According to hydrocarbon exploration records and source rock studies in the onshore Masila Basin, substantial oil reserves occur in the Lower Cretaceous clastic and carbonate rocks as well as fractured basement reservoir rocks. In this study, we have chosen a location within the western central Masila Basin (East Shabowah Block 10), which is close to the major fields of hydrocarbon accumulation in the Masila Basin, as a representative site to model the timing of hydrocarbon generation (Fig. 1). The Upper Jurassic Madbi shales source rock were evaluated and incorporated into the basin modeling in order to improve our understanding of timing of oil generation, expulsion and migration. The Madbi Shales are characterised by a high total organic matter (TOC >2.0 wt %) and have a very good to excellent hydrocarbon generating potential. Kerogen is predominantly algal Type II with minor Type I. The Madbi Shales are mature and, at present, are within the oil window with measured vitrinite reflectance (%Ro) values in the range of 0.65–0.91%. This work on the stratigraphic sequence for of

each well optimized the model of the source rock due to the available geochemical and geological data. This technique is important to develop the burial history, hydrocarbon maturation, and generation history and was achieved by 1-D basin modeling (PetroMod) specialized software to cover the full history of petroleum formation for the selected fields. Modeling results suggest that the oil generation from Upper Jurassic Madbi Formation began in the Late Cretaceous and maximum rates of oil expulsion occurred during the Early Tertiary (Fig. 2). On the basis of the hydrocarbon generation modeling, one can deduce the time of hydrocarbon migration after expulsion. It is believed that hydrocarbon migration in the Masila Basin has continued approximately since Tertiary time, probably during Oligocene and Miocene time, which associated with the Gulf of Aden and Red Sea rifting. The result of the study provides an avenue for exploration strategies of the known location of Upper Jurassic Madbi source rock and exploiting effectively the existing petroleum system.

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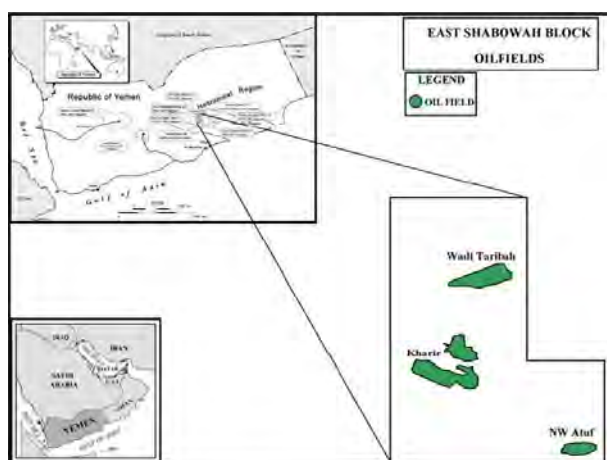


Figure 1: Location map showing the oil fields in the East Shabowah Block 10, western central Masila Basin, Republic of Yemen.

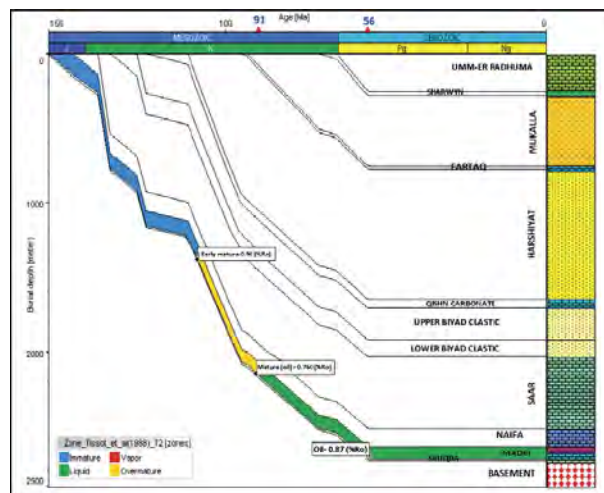


Figure 2: Burial history curves with hydrocarbon zones for the Madbi shale in wells KHA 1-23 in the western central Masila Basin.