Palynofacies, organic geochemical analyses and hydrocarbon potential of some Upper Jurassic-Lower Cretaceous rocks, the Sabatayn-1 well, Central Yemen

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Abstract:

The current work investigates the hydrocarbon potentiality of the upper Jurassic-lower Cretaceous rocks in the Marib-Shabwah Basin, Central Yemen, through the Sabatayn-1 well. Therefore, palynological and organic geochemical analyses were carried out on 37 ditch cutting and 12 core samples from the well. Palynofacies analysis of the Madbi (late Oxfordian-early Tithonian) and Nayfa (Berriasian-Valanginian) Formations sediments indicates deposition of their organic-rich shale, calcareous shale and marl in middle to outer shelf environments under dysoxic-anoxic conditions, containing mainly kerogen of types II to III. However, the shales of the lower Sabatayn (Tithonian) Formation were deposited in an inner shelf environment of prevailing dysoxic-suboxic conditions, and show kerogen types III to II. Regional warm and relatively dry palaeoclimate but with local humid conditions developed near the site of the well is thought to have prevailed during deposition of the studied well sediments. The geochemical analyses of the Madbi Formation show higher total organic carbon content (TOC) than the overlying Sabatayn and Nayfa formations: it is varies between 1.2 and 7, and with average 4 wt% TOC, and the obtained S2 values (~ 3-10, average 7 mg HC/g rock) indicates that the Madbi Formation is mainly good source rock. It shows a good petroleum potential of 4-11 mg HC/g dry rock, and the Rock-Eval pyrolysis indicates mainly kerogen types II to III (oil to gas prone) of hydrogen index values (132-258, and only one sample from Lam Member is of 360 and average 215 mg HC/g TOC). The thermal maturation parameters as Tmax (425-440 °C), production index (average 0.13 mg HC/g rock) and thermal alteration index (2 to 2+) reflected that this formation is present at margin of maturation to early mature stage oil window. So, the Lam Member (upper part) of the Madbi Formation is considered the main hydrocarbon (oil and gas) source rock in the Marib-Shabwah Basin. Accordingly, we predict that the Meem Member is an active source for gas and oil accumulations in the overlying sandstone reservoir of the Sabatayn Formation in the Sabatayn-1 well.

Keywords:

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