Implications of Stratigraphic Modeling on De-Risking Frontier HC Basins: The case of the Levant Basin

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ABSTRACT

This contribution is based on several ongoing research projects dedicated to the understanding of the Levant Basin sedimentary filling and structural evolution, and it aims at presenting the feasibility of developing a new workflow for evaluating source rocks maturity in typical frontier hydrocarbon basins.

Today, the Levant Basin – located in the East Mediterranean region – has earned its position as a new Frontier Gas Province. Offshore discoveries in this Basin (e.g. Noa, Mari-B, Tamar, Dalit, Leviathan, and Aphrodite-A) have confirmed the presence of gas accumulations in subsalt Lower Miocene and Oligocene sandstones (exceeding 35Tcf of recoverable reserves). The East Mediterranean region remains, nevertheless, burdened with a complex geodynamic, tectono-stratigraphic history and high exploration costs (deep offshore drilling, sub-salt reservoirs).

Frontier hydrocarbon basins are usually associated with risky and rather expensive exploration. A very limited number of wells generally exists and seismic data remain the key information that is available for evaluating the basin's architecture and sedimentary filling history (and subsequently its prospectivity). Here, robust geological concepts and uncertainty analyses become crucial tools for sound economic assessment.

Numerical modeling is employed to achieve sound prospectivity analyses and to de-risk exploration, on the condition that the geological understanding of the basin is appropriate. Such modeling tools, that are commonly applied nowadays, should test certain scenarios and lead to optimal consolidation of the proposed concepts. This contribution provides clues on cutting edge technologies and recent innovations with respect to stratigraphic forward modeling based on seismic data and the geological understanding of the investigated basin. Prior to applying classical basin modeling to evaluate the petroleum systems in the Levant Basin, a geological synthesis of the basin evolution is a must. We suggest at this stage to apply advanced forward stratigraphic modeling to provide better constraints for the distribution of the depositional facies in 3D through geological time. Such simulated depositional facies include the potential source rocks (and original deposition of organic matter), potential reservoirs, and seals. The Source-to-Sink and Sequence Stratigraphy methodologies are necessary to guarantee the viability of the interpretations and the proposed concepts (ca. for distribution of organic matter and reservoir rocks). Subsequently, the 3D constructed facies geomodel is transferred to a petroleum system modeling environment, whereby the maturity of the hydrocarbon (gas and oil) could be simulated at the basin scale. This will eventually lead to optimal evaluation of the source rocks maturity in a frontier basin (such as the Levant Basin) and provide further constraints to better assess its prospectivity.