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Basin Modeling: Fluid Distibution Arounding Hassi-Messaoud

Rachid SOULALI & Arezki LASSAL
Sonatrach/Exploration, Boumerdes, Algeria

The Hassi-Messaoud field and its surrounding area is still not well known in regard to the aspects of geodynamic evolution, and the hydrocarbon charging history.

Based on TOC and pyrolysis data, the source rock with the best characteristics is the Silurian radioactive (hot shales). The average original TOC values (prior to maturation and expulsion) of the fine-grained facies of the Silurian radioactive are estimated about 7.5% in the northeastern part (Djemaa touggourt) and average 12% in the northwestern part (Oued Mya). This source rock is assumed to be substantially type II kerogen (original HI= 600 and more) and derived from marine algae and bacteria. Results and Interpretation: The spatial distribution and thickness of the basal Silurian hot shales are laterally discontinous. We interpret that they are controlled by the early Silurian paleorelief and subsequently shaped by the Hercynian erosion. The thickest and areally extensive basal Silurian organic-rich shales occur in the Northern and Western parts of Hassi-Messaoud oil-field, particularly in the north of Oued Mya basin.

The hydrocarbon generation and expulsion occurred rather later, after the major structuration, during early Cretaceous, except for the southwestern area (South of Oued Mya) where they occurred during the Devonian or Carboniferous time.

Large amounts of the generated hydrocarbons (1080 bbl and 730 TCF) were expelled towards Hassi-Messaoud area from the draining area located in the North (i.e. around wells BAT, RDC, MOM and North of Oued Mya). The oil potential is especially increased when the migration pathway occurs at the base of the Triassic sandstone as a conduit for long distances.

For the simulation 2D (TemisPack), 03 cross sections were used around Hassi-Messaoud. These sections were chosen to cover preferential migration zones towards the tops drain areas.

Oued Mya represents the deepest part where the source rocks were buried and preserved from the Hercynian erosion. For these simulations, variable heat-flow history (based on PRV data) was used to calibrate present-day temperature. It appears that the Upper Jurassic-Middle Cretaceous burial was the most important parameter that controlled the source rock maturation.

The Triassic–Liasic evaporates constitute an hydrostatic barrier between the Mesozoic and Palaeozoic formations.

According to these simulations, most of Hassi-Messaoud and satellite fields come from the North and North-West of this area.

The models show a vertical downward and upward migration towards the immediate reservoirs which will then drain the hydrocarbon laterally. The reservoirs and faults are the main parameters controlling the migration pathways.