CHARACTERIZATION OF FRACTURESD HYDROCARBON RESERVOIRS

Israa Abu-Mahfouz
University of Oxford, Earth Sciences, Oxford, United Kingdom
isra.abumahfouz@spc.ox.ac.uk

ABSTRACT

The analysis of natural fracture systems helps to understand the impact of fractures on fluid storage and flow. However, it is poorly understood how stratigraphic architecture, fluid migration, diagenesis, and tectonics interact to create fractures. The Upper Cretaceous through Eocene of Jordan is a potential hydrocarbon reservoir containing abundant natural fractures. The shallow burial depth of the section suggests that the fractures formed under relatively low burial stress conditions, giving an opportunity to study fracture formation during shallow burial conditions. Therefore, the aim of this study is to understand the controls on fracture distribution, to constrain the timing of fracture development and relate that to genesis, to place fractures in a burial and uplift context, and evaluate the effects of fractures on hydrocarbon migration. A variety of analytical techniques are conducted, including petrographic analysis of core and outcrop fractures, geochemical analyses including isotopic and biomarkers analyses of host rocks and fracture cements; geostatistical analyses of fracture intensity, geometry and distribution in core, image logs and outcrops.

A wide variety of natural fractures were observed in the studied section. The most common filling cement of fractures is calcite, but some fractures are cemented by calcite and silica, bitumen or gypsum. Bitumen is present within natural fractures and adjacent vugs, either as macroscopically visible deposits or as inclusions in the fracture cement. Bitumen inclusions suggest that hydrocarbons were generally present during and after the opening of most fractures. Fractures are commonly associated with nodules in the Maastrichtian section, implying that fracturing is sensitive to diagenesis. Different mechanisms controlled fracture formation in the upper Cretaceous (Maastrichtian)-early Eocene which comprises the Jordan Oil and under- and overlying chert-rich units. Fractures were classified into different types based on their timing. These include early calcite fractures propagated during sediment compaction, and late fractures formed during uplift and/or associated to fault reactivations. By integrating data collected from core and outcrop and based on fracture morphology, mineral fill and distribution, we can examine how fractures patterns vary by host rock and through both carbonate and silica diagenesis; place fracture sets into a final structural context presenting the stages of fracture development and evaluate their effects on fluid migration.

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