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Discontinuities Characteristics of the Upper Jurassic Arab-D Reservoir Equivalent Tight Carbonates Outcrops, Central Saudi Arabia

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Jurassic carbonates represent an important part of the Mesozoic petroleum system in the Arabian Peninsula in terms of source rocks, reservoirs, and seals. Jurassic Outcrop equivalents are well exposed in central Saudi Arabia and which allow examining and measuring different scales of geological heterogeneities that are difficult to collect from the subsurface due to limitations of data and techniques. Identifying carbonates
Discontinuities characteristics at outcrops might help to understand and predict their properties and behavior in the subsurface. The main objective of this study is to identify the lithofacies and the discontinuities properties of the upper Jurassic carbonates of the Arab D member and the Jubaila Formation (Arab-D reservoir) based on their outcrop equivalent strata in central Saudi Arabia. The sedimentologic analysis revealed several lithofacies types that vary in their thickness, abundances, cyclicity and vertical and lateral stacking patterns. The carbonates lithofacies included mudstone, wackestone, packstone, and grainstone. These lithofacies indicate deposition within tidal flat, skeletal banks and shallow to deep lagoonal paleoenvironmental settings. Field investigations of the outcrops revealed two types of discontinuities within Arab D Member and Upper Jubaila. These are depositional discontinuities and tectonic fractures and which all vary in their orientation, intensity, spacing, aperture and displacements. It seems that both regional and local controls have affected the fracture development within these carbonate rocks. On the regional scale, the fractures seem to be structurally controlled by the Central Arabian Graben System, which affected central Saudi Arabia. While, locally, at the outcrop scale, stratigraphic, depositional and diagenetic controls appear to have influenced the fracture development and intensity. The fracture sets and orientations identified on outcrops show similarity to those fracture sets revealed in the upper Jurassic carbonates in the subsurface which suggest inter-relationships. Therefore, the integration of discontinuities characteristics revealed from the Arab-D outcrop with subsurface data might help to understand and predict discontinuity properties and patterns of the Arab-D reservoir in the subsurface.