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Fractures Patterns of Tight Carbonates of Upper Jurassic Arab-D Member and Upper Jubaila Formation Outcrops, Central Saudi Arabia

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This study investigates the fracture patterns of the upper Jurassic Arab-D member and upper Jubaila Formation outcropping in central Saudi Arabia. These strata represent the outcrop equivalent for Arab-D reservoir. The upper Jubaila Formation was deposited in the lower to upper slope to ramp crest leading to deposition Stromatoporoid lithofacies association, while Arab-D member deposited under deep to shallow lagoonal settings including skeletal bank and tidal flat lithofacies associations. This study utilized high resolution outcrop scale integrated fracture analysis, sedimentological and stratigraphical approach and methods.The field data included lithofacies, stratigraphic hierarchy, cyclicity and fracture measurements of orientation, length, spacing, intensity, and aperture. The Arab-D member is affected by five fracture patterns: (a) regular large scale fractures NW striking, several meters widely spaced, vertically dipping and cutting through several beds; (b) regular medium scale fractures striking NE and vertically dipping, moderately spaced and extending from two to three meters in length and cut through two or three beds; (c) regular small scale fractures that are arrested near the bed boundary vertically dipping and having less than one meter length and spacing; (d) irregular fractures filled with chemically weathered materials; (e) large scale fractures oriented perpendicular to the first fracture pattern in (a) along the outcrop strike and also cut on the top of the resistive sandy grainstone lithofacies of Arab D member. In contrast, the Upper Jubaila Formation is characterized mostly by medium scale NW and NE striking fractures that near vertically dipping and extended within one or two beds. Irregular small scale fractures also occur within parts of the beds of this group.Fracture formation and development in the Arab D and Jubaila Formation are partially attributed to regional tectonics affected the study area and locally to stratigraphic and sedimentologic controls at outcrop scale. The identified fracture patterns within tight carbonates of Arab D member and Jubaila Formation at outcrop scale is of significance for subsurface reservoirs. The results of this study might help for better understanding and prediction of tight carbonate fracture characteristics, behaviour and their controls on fluid flow in tight low matrix permeability fractured hydrocarbon reservoirs.