New Insights for Kuwait's Lower Fars Formation Exposure over Jal Az-Zor Escarpment: The Importance of Linking Surface to Subsurface

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ABSTRACT

Kuwait Group is comprised of Ghar, Lower Fars and Dibdibba formations from bottom to top, comprised mainly of sandstone, calcareous sandstone and units of clay and carbonates. From the literature, there is no clear definition of both naming nor age of the exposed stratigraphic units. The main challenges highlighted as being the confusion between either Ghar Formation is exposed at the area or not, identification of the contact between Lower Fars and Dibdibba and the depositional setting of the exposed rocks. Authors have suggested that the Lower Fars Formation is carbonate dominated, others consider this unit clastic and deposition took place in fluvial settings, whereas previously it was consider as fluviodeltaic deposits. Such conflicting literature may indicate chaos and a high level of complexity, however in this paper order to this chaotic has been found. To understand this complex setting a number of expeditions have been launched with a goal to traverse the outcrops and produce representative stratigraphic sections. The locations have been selected based on maximum exposure, as most sections are covered. The field based work indicates a clear deposition cyclic nature. Parasequences have been identified and laterally traced. Lateral changes in facies can be dramatic and thickness have been observed to vary over short distances. Such variation could have significant impacts on field development over the Lower Fars Formation in northern fields such as Ratqa heavy oil fields. In addition to the field work, XRD and XRF analysis performed on more than 20 samples revealed new information on the composition of these exposed successions. Grain sizes vary from fine to boulder in size, with extensively cross bedded bioturbated units and carbonate white caps. A typical parasequence starts with a highly bioturbated, cross bedded section that has a significant amounts of lithoclasts, gravel, pebbles and in some cases conglomeratic, gradually transitions upward to bedded units of claystone and siltstone finally overlain by calcareous sands that show evidence of grain reworking with scouring surfaces. The sequence is capped by a white carbonate thin bed and cross bedded sands. These observations combined with lateral facies changes and formation age dating, suggest that these deposits are Lower Fars Formation and only the uppermost part of Jal Az-Zor escarpment is Dibdibba Formation. The work also concludes that Lower Fars Formation in Kuwait extends to the Late Miocene and Ghar Formation is not exposed over Jal Az-Zor escarpment. The Lower Fars Formation reflects a complex setting of marginal marine despites and at least six depositional environments have been recognized. Such understanding can help nearby oil fields in optimizing perforation intervals and minimize sand production, by understanding the cyclic nature and lateral facies changes of these deposits.