

Micro-Fossil Sub-Zones in the Arab Formation for High-Resolution Stratigraphic and Facies Analysis

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ABSTRACT

The Upper Jurassic Arab Formation contains several important hydrocarbon reservoirs in the Middle East. In the western part of the UAE its stratigraphy is regionally established into 4 Members labelled A to D. The Arab A to C Members are characterized by intercalated anhydrite layers, whereas the Arab D Member consists mainly of limestone, dolomitic limestone and dolomite.

Driven by the need for higher stratigraphic resolution inside the Arab D Member during hydrocarbon field appraisal, a pilot study on core and cuttings of 5 wells was conducted based on a detailed micropalaeontological and microfacies thin section analysis. Changes in biotic associations and microfacies, caused by cyclic changes in the depositional setting, are used for the biofacies zonation and palaeoenvironmental interpretation. Based on sedimentological core description, the depositional record from lower Arab D into Arab C is characterized by 3 shallowing upwards cycles consisting of changes from mud- and wackestone dominated (mid-ramp) into laminated packstone/grainstone lithologies (sub- to inter-tidal), latter ones are mostly dolomitized and being interpreted as partially reworked shoal deposits. Most proximal settings observed are represented by mudstones of a restricted lagoon or salt flats.

On the level of biostratigraphic resolution, the Arab D Member is comprised of the bio-zones *Everticyclammina virguliana* (lower Member), and *Kurnubia palastiniensis* (upper Member, including a *Stromatoporid* zone). An actual biostratigraphy for individual cycles or sub-members has not been demonstrated yet. In practise, however, up to 6 sub-members are used as stratigraphic sub-divisions inside the Arab D, mainly directed by reservoir zonation and smaller scale depositional cycles.

In the micro-fossil sub-zonation, the main diagnostic microfossils are the foraminifera *Kurnubia palestinensis*, *Redmondoides lugeoni* and other *Textularioides*. Their abundance shows significant variations throughout the investigated off-set wells. Peak occurrences coincide with the abundance of benthic *Milioides* and indicate times of well-established marine conditions, e.g. specifically the J80 maximum flooding in the upper part of the Arab D member. In contrast, zones of partial to full emergence are characterized by desiccation cracks and rootlet traces. These zones show low bio-diversity by a general lack of marine faunas and moderate amounts of ostracods.

The succession of zones of high foraminifera counts vs. effectively barren zones, together with additional microfaunal elements, allows the distinction of individual facies related microfossil sub-zones. The application of the micro-fossil sub-zones stretches from reconstructing cyclicities in legacy wellbore cuttings to the steering of horizontal wells in zones of low contrast in the standard geo-steering logging suites.