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# A New Exploration Concept in Late Jurassic-Early Cretaceous Interval in Abu Dhabi

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## ABSTRACT

Abu Dhabi has some of the most prolific oil fields in the world. The majority of hydrocarbons currently produced are from a limited section of the stratigraphic column, from four-way closures. This leaves a huge potential of yet to be discovered pools in stratigraphic or combination traps, in other sections of the stratigraphic column. The focus of this article will be the L. Jurassic - E. Cretaceous where changes in basinal configuration and depositional environments, in conjunction with tectonic movements, provide opportunities for favourable trapping mechanisms.

In the Late Jurassic, the Arabian Peninsula was a shallow water platform, undergoing thermal subsidence. The tectonic uplift in the east, possibly related to separation and drifting of India, resulted in westward progradation of the Tuwaiq Mountain-Hanifa-Arab stratigraphic units, and eventually leading to restriction and development of evaporitic basin. Further floundering and down-to-basin normal faulting in the east brought about down warping and subsidence. The resultant deep basin to the east, and simultaneous restoration of the carbonate factory on the shelf, led to further carbonate deposition and progradation, also eastwards.

The study involved examination of number of cores from onshore Abu Dhabi across Asab Oolite/Hith - Habshan unconformity. Well log correlations tied in with core findings were carried out across key wells using Gamma ray, Sonic, Density and Neutron logs. The regional well log correlations depict successively older startigraphic units subcropping to the east beneath the Late Jurassic unconformity. Additionally, westward progradations indicate basinal slope to the east. On the contrary, younger Habshan sediments overlying the unconformity prograde eastwards. This sedimentation pattern suggests change in the basinal slope to the east with significant accommodation created by the tectonic events. The well log correlations indicate thinning of Lower Habshan unit, changes in the lithological characteristics and initiation of prograding oolitic grainstone margin. These 3 observations suggest a possible depositional high between Fields A & B. The log signatures and rock characteristics, as observed in the cores indicate presence of two distinct sedimentary packages within Habshan oolite: the Lower section is dolomitic with evidence of dissolution; whereas the Upper section is calcitic and well cemented.

Seismic interpretation was conducted in parallel with the above work. The seismic data in the northern areas studied was of lower quality than that in the south. Reasons being, the depth of target, and vintage of the data – older surveys tend to have lower fold, shorter maximum offset and larger source and receiver line spacing.

For these reasons, interpretation was more challenging in the northern fields, and several iterations were carried out to map the Late Jurassic unconformity. Regular amplitude sections were used to interpret the unconformity, while instantaneous phase was utilized as a guide. This

surface gave an idea of the topography at the time of deposition of the overlying prograding oolitic sediments. The truncation of Asab Oolite beneath this unconformable surface is clearly brought out in this study. This surface also forms the base over which younger oolitic margin progrades. Acoustic impedance volumes clearly showed the tops of clinoforms as low impedance, which further helped in the interpretation of the Habshan and Asab clinoforms.

As a result of this study, three potential play concepts have emerged in the Late Jurassic Early Cretaceous, influenced by the presence of a topographic high prior to Habshan sedimentation. The first concept is the wedge out of Asab Oolite on the southern flank of Field A. The second concept is the up dip pinch out play involving Lower Habshan lagoonal deposits onlapping onto the aforementioned depositional high. The reservoirs are expected to be thinner and non-continuous. In both these cases, lateral seal is important and is expected to be provided by facies change. Third concept is for Lower Habshan Oolite, which has shown hydrocarbon indications in one well in Field A. Potential, is expected in the thicker parts, especially on the structurally advantageous locales. Risks and uncertainty are mostly in the seal, especially through the faulting that is present in these fields.