

Characterization of Major Seals in Zubair Reservoir Leading to Multiple Fluid Contacts: Raudhatain Field North Kuwait

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Abstract

The Zubair Formation of Hauterivian – late Barremian / early Aptian age is siliciclastic deposit interpreted as a complex unit of initial deltaic origin evolving to estuarine setting with tidal influence. It has been subdivided into three major informal members: lower, middle and upper Zubair. All contain hydrocarbon reservoirs, from where production started in 1955, in the Raudhatain field, a North Kuwait faulted dome. The structure, shale seals and faults of throw less than 100 feet set the trap.

Lower Zubair is a transgressive unit unconformably overlying the Ratawi Formation of late Valanginian age. Deltaic channels, over-bank deposits capped by shales characterize this setting which evolve to shallow marine shoreface calcareous sediments. The middle Zubair is a highstand deposit within the paralic framework developing a sand-channelized scheme where flooding surfaces cap each sand body, interpreted as of autocyclic origin. The upper member exhibits two distinctive packages: a first lower lowstand sand-dominant estuarine channel system, and a second one transgressive / highstand deposition with high shale-sand ratio content.

The initial interpretation of seals related to the shales bounding the sandstone reservoirs is reviewed here in terms of the integrated study of Cores (Description, routine core analysis, SCAL), Correlations, Logs analysis, Repeat Formation Tester (RFT), and Production Logs. Both the static and dynamic models were also reviewed.

The seals are identified as 1. Shale Seals of homogeneous lithology, bounding reservoirs with very different pressures, correlatable across the field as seen in all the three members. 2. Shale Seals which becomes silty but still maintain its character as a “seal package”, recognizable within the upper and middle Zubair members. 3. Diagenetic Seals that occurs as calcareous sandstones / sandy limestones reduce the permeability and become tight and sealing reservoirs, identified at the top of upper and lower Zubair. 4. Tar mat occurrences that behave as seal in clean sandstones and allows to identify three types of fluids, which were documented at the uppermost Zubair sand-channel package and at the middle Zubair. They are regarded as effective in the field, nevertheless a continuous monitoring is going on in order to identify its possible damage/breach.