

## Regional Controls on the Depositional Systems of Key Hydrocarbon Seals of the Arabian Plate

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### Abstract

The hydrocarbon systems of the Arabian Plate contain multiple seals that are effective over large areas. Major regional top seals include both siliciclastic and evaporitic units, either acting alone or in concert. There are also abundant intraformational seals that are sub-regional in extent but account for most of the largest reserves by facilitating stacking of both carbonate and siliciclastic reservoirs. Many of the most important regional and sub-regional seals comprise evaporites, notably the Hith and Arab Formation anhydrites of the southern Plate and the Kurrachine, Alan, Adaiyah, Gotnia/Barsarin, and Gachsaran/Lower Fars/Fatha formations of the northern Plate. Halite is locally important in the Palmyrid Trough, southern parts of the Gotnia Basin in Kuwait and southern Iraq, and the Marib-Shabwa rift basin in Yemen. Key siliciclastic seals include the Triassic Sudair and Aghar shales, Jurassic Dhurma Formation shales, and the Cretaceous Ratawi Shale, Zubair/Gadvan, Nahr Umr, Ahmadi, and Gurpi Formation shales. Carbonate seals, including organic rich facies, are much less prevalent, especially where there are major fracture networks, and particularly where contaminated by minor clay contents forming very effective topseals, such as the Upper Minagish Member of Kuwait. Additionally, in southeastern parts of the Arabian Plate tight carbonate beds form low permeability barriers that partition thick carbonate reservoirs, notably the Thamama Group of the U.A.E.

A regional perspective in conjunction with sequence stratigraphic techniques that enable data to be analysed within a consistent framework is fundamental to understanding the interlinked roles of eustasy, tectonics, and climate in controlling the distribution of regional seals. This presentation identifies a variety of sequence stratigraphic settings responsible for seal deposition on the Arabian Plate:

- Major regressions responsible for widespread shale deposition that can be related to a combination of eustatic sea level change and hinterland uplift (Ratawi Shale, Gadvan and Nahr Umr Formations)
- Transgressive shales associated with rises in relative sea level overlying sequence boundaries (Upper Gharif Member shale, basal Khuff Clastics, Upper Zubair Shale Member, upper parts of Nahr Umr/Burgan Formation, Laffan Formation shale)
- Regional shales associated with maximum flooding surfaces (Zubair Formation intraformational shales, Middle Burgan Member, Nahr Umr Formation intraformational shales)
- Cyclic mixed shallow water evaporite-siliciclastic seals deposited in a compressive setting (Gachsaran/Lower Fars/Fatha Formations plugging accommodation space as it developed in the subsiding foreland basin to the Zagros Mountain Range)
- Lowstand cyclic shallow water evaporite deposition related to differential subsidence and localized tectonic uplift in association with eustatic sea level changes (Kurrachine Formation of Palmyride Trough; Arab and Hith Formations of Saudi Arabia, Qatar and the U.A.E.)
- Lowstand salt deposition within a subsiding rift setting (Late Jurassic Sabatayn Formation in the Marib-Shabwa rift basin of Yemen)