

Arabian Plate Structural Styles and Structural Evolution

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One of the foundations of hydrocarbon exploration and production is the understanding of the structural evolution and its impact on trap formation. Rapid, accurate recognition of structural styles facilitates efficient and thorough fault interpretation. This enables seismic interpreters and explorers to get much more out of seismic data as well as providing improved lead and prospect maps.

This work presents a series of Mesozoic and Cenozoic aged structural style observations from the northern part of the Arabian Plate extracted from various exploration and production scale studies. The Paleozoic and older basement fault framework is illustrated and described in order to show how it impacts later deformation and deformation. The major later regional phases of deformation are the E-W Jurassic rifting with N-S maximum horizontal stress, the late Cretaceous trans-tension with NW-SE maximum horizontal stress (referred regionally as Alpine 1) and the mid-Cenozoic to present day compression related to the convergence between Arabia and Eurasia with NE-SW maximum horizontal stress (referred regionally as Alpine 2). The relation between the large-scale stress field generated by the movement of the Indian plate with respect to the Arabian plate and the structural styles observed will be discussed.

Specific examples from North Kuwait, Abu Dhabi and Oman will be discussed in detail. For Abu Dhabi, we will discuss how the presence and the absence of Hormuz salt has been used to divide the country in structural style domains. The differentiating structural elements comprise:

- Salt domes and diapirs
- NS and NW-SE striking basement features
- forced folds associated with basement features
- drape folds associated with salt domes,
- NW-SE and NNW-SSE conjugate sets of trans-tensional faults zones associated with pop-up structures.

For Kuwait, we will illustrate key observations demonstrating how pre-Jurassic-salt compressional structures have developed in Cenozoic time. The spatial relationships and interaction between the Cretaceous trans-tensional fault patterns of North Oman, Abu Dhabi and Kuwait and the emplacement of the Zagros belt, will be illustrated. Using sandbox experiment analogue models as well as field analogues, it will be demonstrated that these Late Cretaceous trans-tensional faults are decoupled from basement and do not root into any deep basement faults.