

# **Structural Link between Cover Units and an Oblique Strike-Slip Basement Fault: Insights from Modeling of the Shah Structure, UAE**

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## **Abstract**

Three-dimensional seismic data have been used to construct a series of systematic scaled analogue models simulating the structural evolution of the Shah hydrocarbon Field. Models consisted of a set of layers of loose sand on two basal plates whose contact simulated a basement fault. Depositional history of the Shah structure was simulated in the model by producing syn-kinematic deposition and erosion. Deformation of the model was achieved by moving one of the basement plates in a way that it initiated an oblique slip along the basement fault. This oblique movement induced both a strike slip movement in and shortening of the cover sand layers, which resulted in formation of an open anticline (box fold) along the strike of the fault similar to the Shah structure. The 3D seismic mapping of the Shah hydrocarbon Field reveals carbonates dominating lithological units from the Pre Khuff Fm (Permian) to the Dammam Fm (Eocene). A major unconformity in the stratigraphy indicates uplift, exhumation and erosion at Simsima level (Upper Cretaceous) with onlapping of the younger units (Eocene-Miocene Formations). The Shah structure is an open SW-NE striking anticline, which changes symmetry along strike; asymmetric anticline in the SW, a more symmetrical structure in the middle, and asymmetric open anticline in the NE. Model results indicate that the Shah structure is a basement related cover anticline formed due to the oblique movement along a basement fault, which was reactivated during the obduction of Semail Ophiolite and later collision of Arabia with Iranian plate. These results show that this anticline formed without the need for a shortening component perpendicular to the strike of the structure. An oblique slip along a basement fault, with a relatively small degree of shortening could equally well result in the formation of such open and low-amplitude anticline. The modelling results presented here provides an alternative scenario for the formation of Shah structure (low-amplitude, and open) and addresses some of the key questions about its structural constraints (e.g. geometry, and timing and evolution history) by outlining linking it with basement structures. Our modelling results have of high significance for understanding entrapment mechanism and migration pathways, and fracture development. This newly proposed mechanism affects the exploration and development of the Onshore Fields in Abu Dhabi, at the vicinity of Shah Structure.