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Influence of Regional Strains in the Development of Faulted Domes in the Offshore Middle East

Many oil fields in the offshore Middle East have traps in broad domes developed over salt. A recent 3D seismic survey from a fractured Cretaceous carbonate reservoir reveals that one elliptical dome is cut by an array of parallel, NW-SE striking normal faults. We used clay cake models to simulate development of the fault pattern and to understand its relationship to dome shape, stress regime, and fault sequence in the elliptical dome. Our models of dome formation simulated a range of regional strain configurations relative to dome shape and orientation. Fault patterns interpreted from 3D seismic data correlate well with fault patterns developed in models that simulate a regional extension. Our models indicate that evolving faults and fault systems exist simultaneously at a range of sizes regardless of regional strain orientations and magnitude. Moreover, the number of small-displacement faults, those typically undetectable by seismic methods, exceeds the number of faults detected by the resolution of the seismic data. Results indicate that the offshore dome formed in an extensional regional deformation field dominated by NE-SW extension, oblique to the long axis of the elliptical dome. Fault patterns in the models indicate that doming was concurrent with and possibly preceded by regional extension.