Tectonic Controls of Fracturing in the Gulf Region

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This presentation shows the age relationships and tectonic causes of filled and unfilled fractures in the Mesozoic and Tertiary carbonates of the Gulf Region. Well and field data are used to determine the orientations and ages of different fracture sets, and to make inferences about the controlling stress systems. We make the case for examining fracture systems in their regional tectonic context.

An early set of carbonate and anhydrite veins is commonly related to diagenesis of the reservoir rocks. These have a wide range of orientations and are cut by all the later fracture sets. Steeply dipping carbonate and anhydrite veins strike approximately NW-SE, tend to be clustered around normal faults, and are related to Mesozoic NE-SW extension. These veins pre-date hydrocarbon migration, formed when carbonate-rich fluids were circulating, and tend to act as baffles to fluid flow.

Open fractures are related to Late Cretaceous development of the Oman Mountains (commonly E-W striking fractures) and to the Tertiary Zagros orogenic event (commonly NE-SW striking fractures). Earthquake and borehole breakout data show that the dominant orientation of the present-day maximum compressive stress is approximately NE-SW. Local variability occurs, however, including around salt diapirs, adjacent to faults, and along the Batinah Coast of Oman, where gravity-induced sliding has created open fractures that strike approximately NW-SE. Open fractures are synchronous with and post-date hydrocarbon migration, as indicated by the absence of mineral fill. Open fractures improve hydrocarbon mobility, so understanding their age, geometry and distribution has particular significance for reservoir modelling.