**Intergrated Geomodelling of a Salt-Cored Carbonate Dome, Jebel Madar, Oman**

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The Late Cretaceous carbonates of the Middle East include many prolific reservoirs. However, elements of these reservoirs, such as fracture heterogeneity, and permeability and porosity distribution, are still poorly constrained. This study evaluates the fracture heterogeneities and connectivity within carbonate deposits of the Natih Formation, and provides a three-dimensional structural evolution of a salt-cored dome, Jebel Madar, that crops out 140 km south of Muscat, in the Adam Foothills of northern Oman.

The Natih E member is a significant producing unit throughout the Middle East. Natih shallow-water carbonates were deposited on a Cenomanian carbonate platform, and in the Jebel Madar area are comprised of skeletal peloid wackestones, packstones, and grainstones. High resolution SEM analysis (QEMSCAN®) reveals that matrix porosity is dominantly patchy meso-vugular and mudstone microporosity. Permeability of potential reservoir intervals is thought to be largely dependent on an extensive fracture network. The overall fracture system of Jebel Madar is interpreted to be a combination of regional tectonics, overprinted by local radial and concentric fractures due to domal uplift. An evaluation of the mechanical stratigraphy reveals that bed-bounded fractures occur largely in wackestone layers, which are connected by through-going fractures and fracture swarms.

Tectonic events that generated the fracture and fault systems include: obduction of the Hawasina Complex and Semail Ophiolite (Campanian) to the north of the study area, extensional movement due to opening of the Red Sea and Gulf of Aden (Early Cenozoic), and uplift and exhumation of the Oman Mountains (Miocene). Local salt diapirism of the Pre-Cambrian Ara salt is associated with all these tectonic events.

To gain a better insight into the fracture heterogeneity, and porosity and permeability distribution within Jebel Madar, a three-dimensional multi-layered computer geomodel is generated using an integrated dataset that included field-obtained stratigraphic, structural (bedding attitudes, faults, and fractures), and photorealistic LiDAR (Light Detections and Ranging) data, high resolution Quickbird images, and seismic, well-log, and gravity data. Restoration of the computer geomodel has been done to determine the effects of regional and local tectonic events on the structural evolution of Jebel Madar and on the orientation and distribution of the multiple fracture systems present in the Jebel.