Characterization of a Tide-Dominated Heterolithic Reservoir Analog: The Eocene Dir Abu Lifa Member (Western Desert, Egypt)

Legler, Berit [1]; Johnson, Howard D.[1]; Hampson, Gary [1]; Jackson, Matthew D.[1]; Jackson, Christopher A.[1]; El-Barkooky, Ahmed N.[2]; Ravnas, Rodmar [3]; Alsop, David [4]; Le Varlet, Xavier [5] (1) Department of Earth Sciences and Engineering, Imperial College, London, United Kingdom. (2) University of Cairo/Shell Egypt, Cairo, Egypt. (3) Norske Shell, Stavanger, Norway. (4) Shell International Exploration & Production, Rijswijk, Netherlands. (5) Bapetco, Cairo, Egypt.

Heterolithic tidal reservoirs are notoriously difficult to characterize, because the wide range of heterogeneity lengthscales is poorly represented in typical subsurface data and in many outcrops. This study focuses on outcrops of the Late Eocene Dir Abu Lifa Member, Western Desert, Egypt, which offer a unique opportunity to study 3-D facies architecture and heterogeneity distribution on a range of typical subsurface reservoir scales. Data in the form of photopanoramas, logged sections and laser measurements were collected from high (up to 30 m), nearly continuous cliff faces, incised wadis and solitary buttes over an area of c. 1 km2.

The succession is mainly composed of roughly N-S and E-W trending channels, filled with tidal point bars. Channel-fill units are 80 to >500 m wide and up to 18 m thick. Paleocurrents are directed towards the SW or W-NW-N-NE. Tidal indicators include abundant mud drapes, sigmoidal bundles and rhythmites. Channels cut into root-penetrated inclined heteroliths that represent episodic subaerial exposure in a supra-tidal marsh environment. The succession is capped by an intensely bioturbated (Glossifungites ichnofacies) sandstone, recording transgression throughout the study area.

Each channel fill contains a consistent internal architecture that varies from channel axis to channel margin. Erosive channel bases are often lined by mudstones. Laterally to or above these mudstones, planar to sigmoidal cross-bedded sandstone with tidal bundles and mud drapes occur; these are interpreted as complex dunes that migrated in channel axes. However, inclined stratified, silty sandstone and sandy siltstone dominate the channel fills. Inclined beds are characterized by rhythmic, parallel bedding with intercalated wavy- to lenticular-bedded layers, interpreted as sub- and inter-tidal point bar deposits. Elongated lenses of flaser-bedded sandstone are intercalated, interpreted as deposits of isolated simple dunes. Scours filled with fine-grained sandstone or mudstone incise into the point bars. The dip angle of inclined beds and overall grain size both decrease towards the top of the channel-fill successions.

Subsequently, reservoir models constructed from the outcrops will be used to simulate fluid flow, in order to quantify the impact of different heterogeneity scales on effective flow properties and hydrocarbon recovery. Flow simulation studies will be directed towards prediction of reservoir behavior using subsurface measurements.