New Insight on the Glaciogenic Late Ordovician Play of Nord Africa Across a N-S Transect: Reservoir Development and Property Distribution from SW Libya to Tunisia

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Abstract

The glaciogenic Late Ordovician (Hirnantian) play is widespread across North Africa and it is characterized by a large variety of sedimentary facies formed during multiple advances and withdrawal phases of the norther margin of the short-lived (1.4 mln years), ice-sheet which occupied the southern hemisphere at around 445 millions of years ago. The complex depositional processes and paleogeographic settings which developed in this geologic al time are recorded along a North-South transect from SW Libya to Tunisia. Here the Hirnantian sediments are characterized by heterogenous stacking pattern of coarse and fine sediments recording and overall transgressive cycles, mostly related to the overall ice-sheet melt out leading to the global Silurian high-stand. Several lower order regressive and transgressive cycles can be recognized inside the overall sequence which provide further stratigraphic and reservoir complexity. This succession of events, often controlled by local topography shaped by subglacial erosion (tunnel valleys) led to a large heterogeneity of depositional environments also occurring within short distance. They consist mostly of pro- to peri-glacial, glacio-fluvial, fluvio-deltaic, shallow to deep marine deposits. Complex stratigraphic packages consisting of lateral and vertical heterogeneous facies arrangement are often repeated vertically and separated by glacial erosional surfaces caused by multiple phases of glacial advances. The glacial tunnel valleys well documented in the Ghadames, Murzuk and Illizi basins are present locally in southern Tunisia. However, despite the apparent proximal position, large part of the tunnel valleys depressions in the study area are filled with proximal (delta) to distal marine deposits including shoreface, active shelfal deltas alternated with inactive areas where tidal environment can develop. Micro-conglomerates represent only a very small portion of the overall lithology. Reservoir property distribution is therefore controlled by sea-level cycles driven by phases of glacial advances and retreats. The predominant alternating shale and sand is therefore controlling the porosity distribution, trapping mechanisms as well as the geomechanical response of the reservoir to tectonic strain and fracture propagation. Predicting the lateral and vertical staking pattern of these lithologies is therefore key to predict the overall reservoir behaviour to fluid-flow.