



Uplift and Erosion in the Northern Al Kufrah Basin (Southeast Libya)

H. R. Gröger, H. M. Bjørnseth, S. Higgins, C. Vandr , O. Walderhaug, and M. Geiger
StatoilHydro ASA, Forusbeen 50, 4035 Stavanger, Norway (heigr@statoilhydro.com)

The Al Kufrah Basin forms part of the North African continental basin system. While neighbouring basins (e.g. Murzuq Basin, Sirt Basin) are proven petroleum provinces, the Al Kufrah Basin is still in an early stage of exploration. This study combines outcrop studies from the northern basin margin (Jabal Az Zalmah) and the eastern basin margin (Jabal Azbah) with subsurface data in a regional analysis of the key episodes of uplift and erosion in the Al Kufrah Basin. The understanding of the burial and exhumation history of a sedimentary basin is an important parameter for modelling source rock maturation and contributes thus to the evaluation of the hydrocarbon potential.

In a first approach the amount of net erosion is estimated using geometrical reconstructions along two perpendicular cross-sections, based on interpretation of 2D-seismic data. In a second step the resulting net erosion map is integrated with three different analytical methods: (1) Shale compaction analyses (based on outcrop samples and well logs), (2) sandstone diagenesis analyses (based on outcrop samples) and (3) apatite fission track analyses (based on outcrop samples).

Several erosional events are documented in the Palaeozoic stratigraphic record of the Al Kufrah Basin. The major episodes of regional Palaeozoic uplift and erosion occurred in Late Silurian – Early Devonian and in Late Carboniferous – Early Permian (“Hercynian event”). For both episodes a general southward increase in uplift and erosion has been estimated from integrated analyses of seismic and outcrop data. The northern flank of the basin including the Jabal Az Zalmah outcrop area does not appear to have been subjected to major uplift and erosion during these two Palaeozoic events. Maximum burial was reached during the Mesozoic after deposition of Late Permian – Early Cretaceous (?) continental sandstones.

The most important episode of uplift and erosion occurred after the Early Cretaceous (?) sedimentation, leading to net erosion of about 3.5 km at the northern basin margin (Jabal Az Zalmah) and about 2.5 km at the eastern basin margin (Jabal Azbah). Most likely this event occurred in Middle – Late Cretaceous, but a Tertiary age cannot be ruled out. This late phase of major uplift and erosion in the north of the basin resulted in the separation of the Al Kufrah Basin from the Sirt Basin to the north. Hence, the present day geometry of the basin was formed in a very late stage of the basin evolution. The uplift and erosion history in the Al Kufrah Basin can not be linked directly to tectonic events, as large scale faulting is not related to the present day basin boundaries.