

Influence of uplift and erosion on hydrocarbon maturation, expulsion and migration: an integrated analysis of the Ghadames Basin, North Africa

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Uplift and erosion at regional unconformities can have a significant impact on timing of hydrocarbon maturation, expulsion and preservation potential. The Ghadames Basin is a large intracratonic basin on the North African Platform. Regional-scale basin modelling, incorporating data from Algeria, Libya and Tunisia, has been conducted to improve understanding of the effects of tectonics on sedimentation and hydrocarbon generation / migration.

A sequence stratigraphic framework has been developed for the basin, based on wireline log data from over 50 wells. Analysis of isopach and palaeo-isopach maps provides an insight into the structural evolution of the basin, highlighting the importance of erosion on present-day thicknesses.

Initial modelling has been conducted using the Genex and Temis2D software of Beicip-Franlab, to constrain the important controlling parameters on maturation, expulsion history and migration pathways across the basin. Models are calibrated with present-day temperature, vitrinite and pyrolysis data. Estimation of eroded overburden at the regional Hercynian and Alpine unconformities determines timing of maximum burial of source rocks, and thus has a direct impact on their temperature and maturity evolution. Calibration data indicates pre-Hercynian maximum burial on the western margin of the basin, with 90-98% of generation potential of the Silurian source rock realised prior to Hercynian uplift. Mesozoic-Cenozoic maximum burial occurred over the central depression, with 50-90% of generation potential preserved into the Mesozoic, depending on the amount of Hercynian erosion modelled. On the eastern margin two burial histories are considered: (1) pre-Hercynian, and (2) Cenozoic (pre-Alpine) maximum burial.