The Atlantic Margin Project (AMP): Integrated Source-To-Sink Analysis of the Southern Moroccan Continental Margin (Tarfaya Basin)

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The Atlantic Margin Project (AMP) represents a multiple-disciplinary applied research project which the objective of an improved understanding of source-to-sink processes with major links to hydrocarbon exploration in the Tarfaya Basin. Five subprojects have focused on the following topics and approaches:
(1) Biofacies, Biostratigraphy, Paleoecology, Sedimentology, Climate and Erosion Systems Analysis; (2) Sediment Fluxes and Erosion of Source Areas; (3) Thermal Parameters, Thermochronology and time-Temperature history; (4) Source Rock Characterization, Source Rock Petrology and Source Rock Kinetics; (5) Sequence Stratigraphy and Basin Development of the Tarfaya Basin.
Detailed results will be published in individual presentations, while this presentation will provide an overview and a synthesis of AMP.
Four research wells have provided an unprecedented continuous biostratigraphic, geochemical and paleo-ecological record based entirely on cores. It provides a high-resolution biostratigraphic calibration for the Late Cretaceous of the Tarfaya basin which includes several proven source rock levels. Paleo-ecological and sedimentological analyses provide mutual links to source rock, depositional environment and sequence stratigraphic analyses. Based on the carbon isotope curve the Tarfaya Basin can be tied into other Upper Cretaceous reference sections, e.g. in the Britain.
Cretaceous to Paleogene source rock evaluation for the Tarfaya Basin indicates increased charging risks. Cretaceous source rocks in the deep offshore have experienced limited burial depths, which are responsible for their lower maturities. Kerogen quality decreases towards the shallow offshore and onshore. Closely spaced 2D or 3D seismic coverage is required to reveal regional depocenters (e.g. intra-salt basins, turbidite fan systems) in the deep offshore, where the Cretaceous to Paleogene SRs may have reached higher burial depths and maturity levels.
Total post-Early Carboniferous exhumation in the Anti-Atlas reached approx. 10.000 m. Exhumation was rapid until the Late Triassic, but significantly reduced during Jurassic to Cretaceous times. While the northeastern, middle and southwestern Anti-Atlas shares a similar exhumation history since the Early Carboniferous, the southern Anti-Atlas/Bas Draa area differs with major exhumation continuing throughout the Jurassic to Cretaceous. The thermochronological record in the Tarfaya sink area goes back to the Aptian to Albian, when maximum burial depths of 2000 m (S) to 1000 m (N) occurred. Exhumation of the Tarfaya Basin started around the C/P boundary with initial Atlasian compression.
Sequence stratigraphy provides the temporal and spatial framework for HC systems analysis, especially in terms of an improved assessment of charging, migration and trapping risks. High-resolution analyses at sub-reflector scale integrated with well log analyses indicate the position, areal extent and lateral migrations of high-quality source rock and reservoir intervals in time.
Current results of the Atlantic Margin Project, although restricted to 2D transects, show that major

lateral heterogeneities in shelf architecture and basin fill exist along the Tarfaya shelf margin. Exploration concepts in the Tarfaya Basin need to be specifically focused on the depositional, architectural and temperature history of subbasins and their individual hinterlands. 3D datasets are an important pre-requisite. Numerical basin modeling provides a quantitative link between source area studies (sediment input), crustal response (sediment loading), depositional systems (source rocks, reservoirs) and structural development (migration pathways, traps, seals).