Geophysical Research Abstracts
Vol. 21, EGU2019-10682, 2019
EGU General Assembly 2019

New constraints on source to sink systems of NW Africa: provenance analysis of the Mesozoic post-rift clastics in the Essaouira-Agadir Basin (Morocco)

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Recent thermochronological work has established several uplift phases in the main orogenic belts of Morocco (the Moroccan Mesetian and Atlasic domains). The results identify: (1) km-scale uplift and subsidence episodes recorded during the post-rift evolution of the margin (Jurassic to Lower Cretaceous) and (2) well-constrained highly asynchronous dynamic vertical movements in the northern (Meseta and Western High Atlas) and southern domains (Anti-Atlas and Reguibat Shield). This evolution highlights a more tectonic active flank of a passive margin than previously recognised, which will have controlled both the origin and distribution of sediments delivered to the subsiding basins along the margin. Untangling the complex post-rift evolution of the NW African margin is fundamental to constraining the behaviour of the shallow-marine to fluvial transition zone as well as the formation and distribution of potential reservoirs.

The Lower Cretaceous regression recorded in the Essaouira-Agadir basin with shallow-marine to fluvial coarse siliciclastic units, and potentially deepwater facies, are an exploration target offshore. However, limited success in recent drilling campaigns reflects the poor understanding of the depositional systems from source to sink and its links to the eroding hinterland.

This integrated provenance analysis offers new constraints on a regional source to sink model of North West Africa by deciphering the controls, timing and volume of the sediment supply to the margin and by providing new evidence of the importance of sediment recycling, mixing and storage. The main focus is on the late Early Cretaceous (Latest Barremian to Earliest Aptian) marine regression that is associated with substantial input of detrital sediments into the deep-water basins. The study area offers a unique opportunity to study a well constrained source to sink system, where integration of data from superbly exposed outcrops with tectonic analysis allows testing of models for delivery, mixing and storage and development of new models for the evolution of passive margins and controls on sediment delivery.

To assess the multiple origins of the sediment supply, a detailed petrographic study has been conducted along with SEM and QEMSCAN imagery. It has demonstrated the occurrence of various granitic and volcanic clasts mixed with recycled sedimentary grains, likely from both intrabasinal and hinterland origin. Generation of reconstructed palaeogeological maps integrated with detrital zircon geochronology and heavy mineral analysis indicates a source shift between the Jurassic and the Cretaceous, with an input of sediments likely from the Anti-Atlas during the Lower Cretaceous. The study is currently focusing on source discrimination based on the heavy mineral populations and erosion modelling. This would yield data not only on the provenance but will have implications on the sediment volumes and nature allowing a better prediction of the potential offshore reservoirs.