Geophysical Research Abstracts,
Vol. 11, EGU2009-10646, 2009
EGU General Assembly 2009

Morphologic and structural evolution of the Algerian Margin since Messinian (-6 Myr); First results of a new experimental approach.

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In the framework of the ANR (Agence Nationale de la Recherche) DANACOR Project, dedicated to the seismo-tectonic study of the Algerian Margin, we have developed an experimental approach based on a new type of analog models to investigate its morpho-structural evolution over the last 6 Myr. Present day structure of the Algerian margin results from a polyphased geologic evolution starting, during Late Oligocene, with the opening of the Western Mediterranean Sea. During lower Miocene, back-arc extension and slab roll-back, associated to the Tethyan oceanic subduction induced accretion of the Kabylian crustal blocks against the North African passive margin. At the end of Miocene, a main tectono-climatic event occurred, the Messinian salinity crisis, that left a significant footprint on the marine sedimentation and coastal morphology. Finally, during Upper Pliocene and Quaternary, due to the ongoing crustal convergence between Africa and Eurasia, the Algerian Margin experienced active compression as shown by north dipping thrusts located onland (Yelles et al., 2006) and south dipping reverse faults located at sea (Déverchère et al. 2005, Domzig et al., 2006). The occurrence of moderate to strong compressive earthquakes, such as the Boumerdes earthquake (Mw 6.9, 2003) indicates that the deformation is still active. In such a context, the objectives of our study are to evaluate the impact of the Messinian salinity crisis on the morphological and sedimentological evolution of the margin and to test different hypothesis concerning the recent compressive tectonic event that developed in the last millions years and more particularly how it affects the margin and coastal domain tectonics. To model a whole continental margin, we've modified a recent experimental technique developed initially to study the interactions between Tectonics-Erosion-Sedimentation (TES) in active mountain foreland (Graveleau and Dominguez, 2008). Erosion of emerged topographies (coastal domain) is produced by sprinkling thin rain droplets on the model surface. Boundary conditions, models rheology and dimensioning parameters were determined using the available geologic and geophysical data. For such complex models, rigorous dimensioning cannot be achieved but, at a first order, 1 cm in the model can be considered as equivalent to 500 m in nature and 1s to about 50 years. Up to now, we performed 5 main experiments to determine the boundary conditions in terms of geometry and internal structure and also to find the most appropriate analog material rheology. All experiments started at the beginning of the Messinian salinity crisis (-5.96 Myr) by a rapid decrease of the sea level to -2500m (-5 cm), followed by 400000 yr (2 hours) of a low stand sea level. A specific material is then manually deposited to simulate the Messinian evaporites. During this stage, extreme erosion, creating several huge canyon systems on the emerged margin and onland, is observed as well as large fan deposits at the base of the margin. Finally, we induce a rapid sea level rise to simulate the replenishment of the Mediterranean Sea at -5.33 Myr. During the next 2 Myr (10 hours), only erosion of the coastal domain is performed resulting in progradation of marine sediments that deposited on the margin proximal domain. Near the end of Pliocene (about -2.3 Myr), compressive deformation is imposed and the model starts shortening. During this stage, that lasts more than 12 hours, reverse faults dipping landward develop together with a few backthrusts that affect the coastal domain as it is observed on the Algerian margin. A significant part of the upper domain of the margin emerged, inducing a seaward displacement of the coastal line. These new reliefs enhance erosion onland and sedimentation at sea that interact with the different active faults.
This work represents a first attempt to model a tectonized continental margin by including realistic onland and at sea geological processes. Even if some work is still required to better take into account the specificity of the

Algerian Margin, it allows to discuss the impact of the different tectono-climatic events undergone by the margin on its present day evolution.

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