

Geophysical Research Abstracts
Vol. 16, EGU2014-11097-1, 2014
EGU General Assembly 2014
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Offshore fault system in the Al Hoceima region from new high-resolution bathymetric and seismic reflection data

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The Al-Hoceima Region (Morocco) is the one of the most active seismic area of the western Mediterranean Sea. Detailed surveys in a shallow water environment are required to identify the connecting onshore-offshore active structures and to propose a tectonic framework. We use combined high-resolution seismic reflection and swath-bathymetry data from the Marlboro-2 cruise, which took place in 2012 off the coast of Al Hoceima, to detail the fault system through the Nekor basin, between the Trougout Fault and the Boussekour Agdal fault. The Boussekour-Agdal fault is a N026 oriented fault, dipping east and affecting the plio-quadernary sequence offshore and the internal units of the oriental Rif onshore. The fault trace shows a vertical offset of 6.5 m on the high-resolution swath bathymetry close to the shoreline, while the northern prolongation of the fault is buried. The Bokkoya fault (Calvert et al. 1997) is a N029 oriented fault dipping east. The vertical offset at the seafloor is 13m. This fault affects sedimentary structures above a paleo-terrace at -105mbsl, probably related to the last sea-level fall. The onshore-offshore N-S oriented Trougout fault corresponds to the eastern boundary between the plio-quadernary Nekor basin and the volcano-clastic deposits of Ras Tarf. This fault produces a vertical offset of 2.3m at the sea-floor. These three major fault zones limit two basins: the Nekor basin between the Bokkoya and the Trougout faults, and a depression between the Boussekour-Agdal and the Bokkoya Faults. The quadernary deposits are syn-tectonic. In the Nekor basin secondary normal faults are oriented N150, shift the sea-floor and affect the Messinian unconformity. Successive positions of a paleo-canyon (seen in the seismic lines) show a migration of the subsidence from east to west inside the Nekor basin. Faults affecting the Messinian unconformity control this subsidence. Between the Boussekour-Agdal and the Bokkoya faults, the thickness and the geometry of the plio-quadernary deposits over the Messinian unconformity may indicate a more recent subsidence. We interpret these structures as a sinistral transtensional tectonic system. The migration of the subsidence from east to west during the Plio-Quadernary and the geometry of the tectonic structures indicate the progressive abandoning of eastern structures in the Nekor basin.

Keywords: Bathymetry, Tectonics, Seismic, Nekor basin, Morocco