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Seismic imaging of seismogenic (active strike-slip) faults in the South Iberian margin

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Seismogenic faults may be silent in the historical period and, therefore, its seismic potential may remain inadvertently hidden. In highly active areas it has been demonstrated that a paleoseismological analysis can detect and characterize the seismic potential of these faults providing their seismic parameters (geometry, segmentation, maximum magnitude, slip-rate, recurrence period and elapsed time), also in slow moving faults with large recurrence periods (104yr). A number of seismogenic faults with low slip-rate may be present in the boundary between Iberian and African plates. Thus, this approach is critical to estimate realistic values of the seismic hazard in this area.
The present-day crustal deformation of the southeastern Iberian margin, which includes the Iberian Peninsula, Morocco and Algerian margins, is driven mainly by the NW¬-SE convergence (4-5 mm/yr) between the African and Eurasian plates. This convergence is accommodated over a wide deformation zone with significant seismic activity south of the Iberian Peninsula. Seismicity is mainly characterized by low to moderate magnitude events. Nevertheless, large destructive earthquakes (MSK Intensity IX¬-X) have occurred in the region, as has been revealed by historical records. This may pose significant earthquake and tsunami hazards to the coasts of Spain and North Africa.

The main goal of the EVENT national project (“Integration of new technologies in paleoseismology: Characterization of seismogenic and tsunamigenic faults in South Iberia) is to characterize selected active faults (onshore and offshore) located in the Alboran Sea by means of paleoseimic studies. These structures may represent a seismic and tsunamigenic hazard for the surrounding coasts of South Iberia and North Africa.
During the EVENT-DEEP cruise, carried out from 10th May to 7th June 2010, the geomorphology and geometry of some active strike-slip fault tectonic structures identified in the Eastern Alboran Sea, focusing on the Yusuf Fault and structures at the SE Alboran Ridge, and the northern Morocco margin, particularly Alhucemas fault, have been investigated. These structures may be sources of large earthquakes and tsunamis. MCS, multibeam echosounder and parametric sub-bottom profiler lines have been acquired, together with gravity data, in order to accurately determine the fault seismic parameters of the active faults (e.g. geometry, slip rate, maximum event magnitude, recurrence interval and time elapsed since the last earthquake, maximum earthquake they can produce) to investigate how they accommodate the present-day strain regime along the Eurasian-African plate convergence. During the cruise, we also have obtained sediment sampling, video and photograph images (groundtruthing) on selected sites for a particular study of habitat mapping (deep coral mounds) around the Chella Bank and the Alboran Ridge.