Active strike-slip faults offshore the South Iberian Margin (Alboran Sea and Gulf of Cadiz): Implications for submarine paleoseismology

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Crustal deformation in the south Iberian margin, which includes the offshore Atlantic and Mediterranean regions, is driven mainly by the NW–SE convergence (4-5 mm/year) between the African and Eurasian plates. Convergence is accommodated over a wide active deformation zone, mainly distributed among reverse to strike-slip faults that dominate along the eastern Alboran Sea and external Gulf of Cadiz. Regional seismicity is characterized by shallow to deep earthquakes of low to moderate magnitude (Mw < 5.5) although, large and destructive earthquakes (Mw ≥ 8.0 and MSK Intensity X-XI) such as the 1755 Lisbon Earthquake, have also occurred in the region and may represent a significant earthquake and tsunami hazard along the Iberian Peninsula and North African coasts. We will present an overview of large, slow-moving strike-slip submarine faults recently identified in the south Iberian Margin. The data has been acquired during successive marine geophysical surveys carried out in the frame of national and European projects.

Fault exploration of active strike-slip fault systems integrate the most advanced technologies covering different scales of resolution. Acoustic mapping techniques, such as swath-bathymetry and sidescan sonar data, allow identifying its seafloor expression, such as fault traces and scarps, deflected channels, pressure ridges, water gaps. Sub-seafloor seismic imaging methods, ranging from high-resolution sub-bottom profiler (uppermost tens of meters of penetration) to multichannel seismic data (several km of penetration) allow detecting the stratigraphic evidence of past seismic activity, such as displaced seismic horizons, folded and faulted reflectors, zones of shearing and discontinuities. Sediment sampling methods and subsequent analyses allow knowing the nature and age of the most recent faulted sedimentary sequences.

In the Alboran Sea, we will mainly focus to the marine terminations of the Eastern Betic Shear Zone, such as the left-lateral Carboneras and Al-Idrissi faults, and associated structures such as the dextral Adra and Yussuf fault zones. In the Gulf of Cadiz, we will focus on the large WNW-ESE trending dextral strike slip fault zones, referred as the Lineaments N and S, which extend for hundreds of km from the abyssal plain to the inner part of the Gulf of Cadiz. In some cases, such as in the onshore-offshore Carboneras Fault, an exhaustive paleoseismic analysis has been possible. In other faults, such as Adra and Lineament S, we have been able to relate them with historical or instrumental earthquakes, respectively. Our main goal is to precisely characterize the shallow and crustal structure of these active strike-slip faults in order to evaluate their seismic potential, which may represent a significant earthquake and potential tsunami hazard for the coasts of Western Europe and North Africa.