

Active tectonic structures in the Gulf of Cadiz: a multiscale view

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The Gulf of Cadiz is located in the southwestern margin of Iberia, along the NE-SW convergence between the African – Eurasian plate boundary (3.8-5.6 mm/yr). The area has been the source of historical and instrumental earthquakes, most of them with a moderate magnitude ($M_w \approx 5.5$), although large and great earthquakes also occurred in the area, such as the 1st of November 1755 Lisbon earthquake and tsunami ($M_w 8.5$) and the 28th February 1969 Horseshoe earthquake. Recent studies of turbidite paleoseismology in the external part of Gulf of Cadiz found that the regional recurrence interval for Great earthquakes ($M_w \geq 8$) is about 1800 yr. We have investigated the Gulf of Cadiz area for more than 15 years, carrying out bathymetric, sidescan sonar, shallow and deep multichannel seismic, wide-angle seismic and sediments sampling surveys. We focus our investigations on active structures located at the external part of the Gulf of Cadiz, corresponding to two main families of active faults compatible with the current plate convergent in the region: the WNWESE dextral strike-slip faults (Lineaments) and the NE-SW thrusts faults. The activity of these lineaments (Lineament N and S) is demonstrated by the presence of deep (>4 km) mud volcanoes formed along the faults traces, evidence of rising deep fluids and formation of gas hydrates, as well as their seismic activity, characterized by shallow to intermediate depths (8-55 km). The LS, is a dextral strike-slip fault of more than 600 km long, and has been considered as the boundary between the African and Eurasian plates. Regarding the NE-SW trending faults, they consist of thrusts, and they are active since the Neogene. The main faults are: (1) The Marquês de Pombal Fault a 55 km long west verging monocline thrust and characterized by the presence of mass movements, likely triggered by earthquakes. (2) The Horseshoe Fault is an NE-SW trending, 110 km-long anticline thrust. (3) The Coral Patch Ridge Fault is a 160 km long fault with a rhomboidal shape that separates the Horseshoe Abyssal Plain from the Seine Abyssal Plain. There are composed by two main anticline NW-verging thrust faults. These faults cut, fold and show growth-strata configuration in the most recent sedimentary units of Holocene age, indicating that they are active. (4) The Gorringe Bank is by far the most prominent structure in the Gulf of Cadiz. It is a compressive structure raised by a large-scale thrust over the Tagus Abyssal Plain. Nowadays, the Gorringe Bank is a source of low-magnitude seismicity located at depths between 20 and 40 km. In the forthcoming INSIGHT cruise (May 2018) we will carry out specific high-resolution surveys in some of these areas to obtain detailed and accurate high-resolution data of seismogenic structures. In this cruise, we will use the AUV “Abyss” to carry out microbathymetric survey and ultra-high resolution seismic profiles. The new information will be complete with high-resolution 2D multichannel seismic profiles. High-resolution multiscale data will allow us to carry out an accurate interpretation and understand better the active tectonic processes occurring in the Gulf of Cadiz.