Tectonics of the Coral Patch Ridge Area and Adjacent Horseshoe and Seine Abyssal Plains (Gulf of Cadiz) Based on New Multichannel Seismic Data

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During June 2006 we carried out the ESF-EuroMargins SWIM marine geophysical cruise on board the Spanish RV Hespérides (PI. E. Gràcia) with the main objective to characterize the geometry, deep structure and timing of deformation of the active faults located at the westernmost Gulf of Cadiz (SW Iberian Margin). This region is where the epicentres of recent large magnitude earthquakes are located, such as the 28 February 1969 (Mw 8.0) and the 12 February 2007 (Mw 6.0). We acquired 16 high-resolution multi-channel seismic (MCS) profiles together with Simrad EM120 swath-bathymetry and TOPAS sub-bottom profiler, totalizing more than 2700 km of data. Here we will focus on the Coral Patch Ridge (CPR) and the adjacent Horseshoe and Seine Abyssal Plain corresponding to the profiles SW8 to SW16. Seismic acquisition was performed using a 10 m long 8-airgun array totalling 1050 c.i. and a streamer with 2.4 km of active section, totalizing 96 channels with 25 m separation. Standard MCS processing was accomplished using PROMAX software, and included: data re-sampling at 4 ms, channel and shot editing, top mute in shot gather domain, true amplitude recovery, antialias, FK fan filter, band-pass filter, predictive deconvolution, geometry CMP gather, NMO, stack, and Stolt FK migration (1500 m/s). The MCS lines presented here were acquired in order to obtain the best image of the structure and tectonic evolution of the Horseshoe Abyssal Plain (HAP), the Seine Abyssal Plain (SAP) and Coral Patch Ridge (CPR). This set of lines help us to understand the distribution of the deformation in the study area, the involvement of basement in the regional tectonics, and the seismic activity occurring on the region. The basement and sedimentary cover are clearly imaged on the MCS profiles. We have differentiated six seismo-stratigraphic units: I) a Triassic to lower Jurassic unit, composed of evaporites and carbonates; II) an upper Jurassic to Aptian unit, made up of marls and limestones; III) an upper Cretaceous to lower Eocene terrigenous unit; IV) an upper Oligocene to Miocene unit, only recognized at the HAP; V) the Allocthonous Unit of Gulf of Cadiz of Tortonian age, and VI) the uppermost unit of Plio-Quaternary age, composed of hemipelagites, countourites and turbidite layers. The structure of the basement follows a horst and graben geometry corresponding to the Mesozoic tectonic pattern, reactivated during the Neogene. The CPR is composed of a series of positive relieves corresponding to the eastern prolongation of the Coral Patch Seamount which abruptly ends against a NW-SE trending fault. The CPR consists of a series of narrowly spaced ENEWSW trending folds and thrusts mainly with NW vergence, although conjugated faults are also observed, corresponding to the Seine Abyssal Hills. We have also identified a 300 km long WNW-ESE trending lineament corresponding to an active dextral strike-slip fault that cut across most of the HAP, the Horseshoe Fault and the western part of the Gulf of Cadiz accretionary wedge. Present-day active faulting is observed at the HAP and SAP, mainly subvertical faults cutting the whole sedimentary sequences up to the surface. They are also associated with earthquake swarms. Forthcoming pre-stack migration of selected MCS profiles in the frame of the EUNEAREST project will allow us to obtain the corrected geometry for detailed neotectonic interpretation and calculation of fault seismic parameters.