Trabajos de Geología, Universidad de Oviedo, 30 : 49-54 (2010)

Pre-stack depth migration seismic imaging of the Coral Patch Ridge and adjacent Horseshoe and Seine Abyssal Plains (Gulf of Cadiz): tectonic implications

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Abstract: Recently acquired multichannel seismic (MCS) profiles during the SWIM-2006 cruise allow us to characterize the shallow and deep geometry and timing of deformation of the structures comprising the Coral Patch Ridge and adjacent Horseshoe and Seine Abyssal Plains (SAP), at the westernmost Gulf of Cadiz. This region is where the epicentres of the largest instrumental earthquakes occurred, such as the one on 28th February 1969 (Mw 8.0). We present a detailed seismo-stratigraphic and tectonic interpretation of two SWIM-2006 MCS profiles that we have pre-stack depth migrated in order to correct the reflectors geometry. Based on drilled wells, we have distinguished six seismo-stratigraphical units (from Triassic to Plio-Quaternary). We have also characterized the 300 km long WNW-ESE lineaments, corresponding to an active dextral strike-slip fault, and the geometry of the Coral Patch Ridge. Finally, present-day active faulting has been observed at the Horseshoe Abyssal Plain and SAP, mainly corresponding to subvertical faults cutting the whole sedimentary sequences up to the surface, some of them associated with earthquake swarms.

Keywords: Gulf of Cadiz, multichannel seismics, seismo-stratigraphy, strike-slip fault, thrust fault, seismicity.

The study area is located in the SW Iberian Margin, in the westernmost part of the Gulf of Cadiz. This region hosts the present-day convergent boundary between Eurasian and African plates (4.5-5.5 mm a^{-1}) (Grimison and Chen, 1986; Argus *et al.*, 1989) and is characterized by moderate to intense magnitude seismic activity (Buforn *et al.*, 1995; Baptista *et al.*, 1998b; Stich *et al.*, 2005). The Gulf of Cadiz is also the source of the largest seismic events in Western Europe, such as the 1st November 1755 Lisbon Earthquake (Mw 8.5) (Johnston, 1996) and the 28th February 1969 one (Mw 8.0) (Fukao, 1973). Recent estimations of depth and seismic moment tensors (Mw 3.8 to 5.3) for the earthquakes that have occurred in the area show reverse and strike-slip faulting solutions at a depth ranging between 6 and 60 km (Stich *et al.*, 2007).

Numerous marine geophysical cruises have been carried out in the region during the last fifteen years (Sartori *et al.*, 1994; Banda *et al.*, 1995; Gutscher *et al.*, 2002; Gràcia *et al.*, 2003a, b; Terrinha *et al.*,