

Neogene Through Quaternary Tectonic Reactivation of SW Iberian Passive Margin

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Abstract—Southwest Portugal, the Gulf of Cadiz and Morocco are under the potential threat of natural hazards linked to seismicity and tsunami generation. We report the results of two multi-channel seismic (MCS) surveys carried out in 1992 and 1998 along the continental margin and oceanic crust of SW Iberia. This MCS data set shows the evidence of the compressional deformation which involves both the continental and the oceanic crust of the study area. The area of deformation extends from the southern border of the Tagus Abyssal Plain to the Seine Abyssal Plain, encompassing the continental margin of SW Portugal. Most of the structures observed are probably related to a Mid-Miocene phase of Africa-Europe plate convergence. In this paper we discuss the recent advances on the identification of the tectonic structures that are still active and that may generate great earthquakes and tsunamis. The tectonic structures identified are located respectively at the Guadalquivir Bank, along the eastern border of the Horseshoe Abyssal Plain and along the southern continental slope of SW Portugal.

Key words: Southwest Iberia, seismic reflection data, active faulting, compressional tectonic, earthquake, tsunami.

Introduction

Since historical times a number of destructive earthquakes/tsunamis has been reported to have occurred in SW Iberia like the tsunami of 60–63 B.C., which devastated the city of Cadiz, and the 1531 and 1722 events that struck the coasts of SW Portugal. This area was also the source of the famous 1755 Lisbon Earthquake

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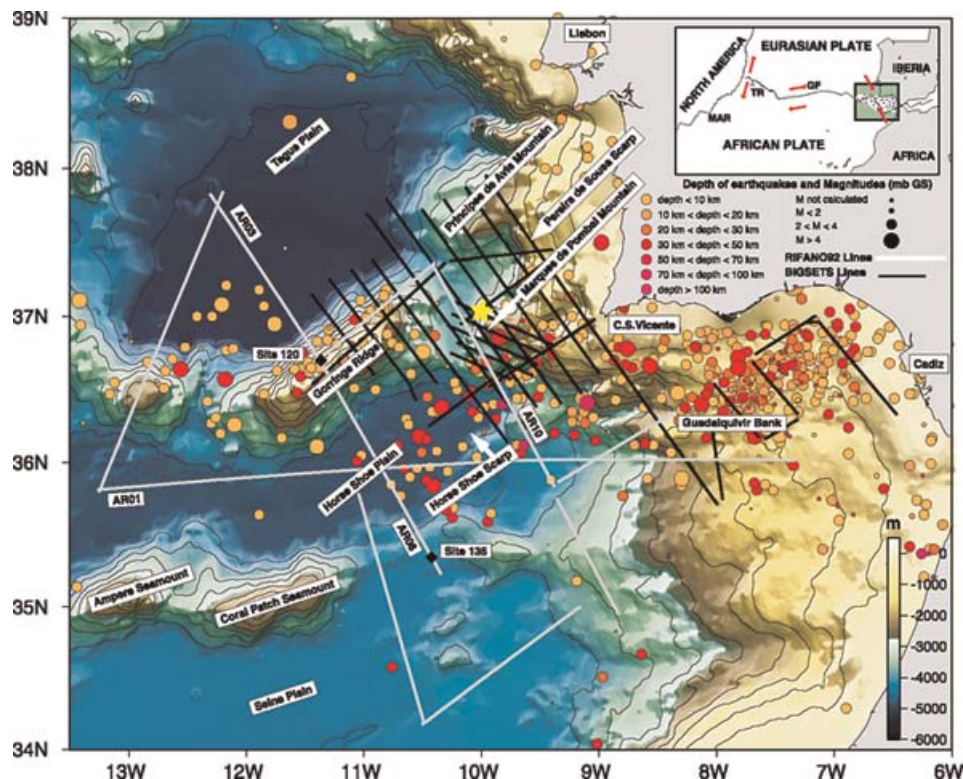


Figure 1

Bathymetry map of the study area (data from GEMCO97 Digital Atlas Web Site: www.nbi.ac.uk) with location of earthquakes ipocenters recorded during 1973 to Present (data retrieved from USGS National Earthquake Information Center, World Data Center for Seismology, Denver, PDE catalog at <http://www.neic.cr.usgs.gov>). Also shown the location of MCS lines acquired during RIFANO92 and BIGSETS98 surveys. The yellow star indicates the position of the 1755 A.D. event (from UDIAS *et al.*, 1976). Inset sketches the main elements of plate boundaries (data from NOAA Global Relief Data), the stippled patch indicates the absence of a well-defined plate boundary: MAR: Mid Atlantic Ridge; TR: Terceira Ridge; GF: Gloria Fault. Solid arrows display relative plate kinematics, after BUFORN *et al.* (1988).

(yellow star in Fig. 1), the most terrifying cataclysm to have occurred since historical times in Western Europe with an estimated earthquake magnitude of 8.5–8.7 (MARTINS and MENDES VICTOR, 1990). That day, in Lisbon alone, between 10,000 to 60,000 people died, 10% of them due exclusively to the tsunami. The earthquake was so strong as to be felt throughout Europe as far as Belgium, Finland and Northern Africa. The generated tsunami wave reached the Caribbean Sea and the coasts of Great Britain (see for a review BAPTISTA *et al.*, 2003). The tsunami wave heavily damaged the coasts of SW Portugal, Western and Northern Morocco and the Gulf of Cadiz, reaching a height of 30 m in C. S. Vicente (SW Portugal).

During the Nineties two multi-channel seismic (MCS) surveys, RIFANO92 (SARTORI *et al.*, 1994) and BIGSET98 (ZITELLINI *et al.*, 2001), have been carried out