Lebreiro, S.M., McCave, I.N., Weaver, P.P.E., Late quaternary turbidite emplacement on the Horseshoe Abyssal Plain (Iberian Margin), J. Sed. Res., 67, 5, pp 856-870. 1997.

Sartori, R., L. Torelli, N. Zitellini, D. Peis, E. Lodolo, Eastern segment of the Azores-Gibraltar line (central-eastern Atlantic): An oceanic plate boundary with diffuse compressional deformation, Geology, 22, pp 555-558. 1994.

Stich, D., Mancilla, F., Morales, J., Crust-mantle coupling in the Gulf of Cadiz (SW Iberia), Geophys. Res. Lett., 32, L13306, doi:10.1029/2005GL023098. 2005

Terrinha, P., Pinheiro, L.M., Henriet, J.P., Matias, L., Ivanov, M.K., Monteiro, J.H., Akhmetzhanov, A., Volkonskaya, A., Cunha, T., Shaskin, P., Rovere, M, Tsunamigenic-seismogenic structures, neotectonics, sedimentary processes and slope instability on the southwest Portuguese Margin, Mar. Geol., 195(1-4), pp 55-73. 2003.

Zitellini, N., Mendes Victor, L., Córdoba, D., Dañobeitia, J.J., Nicolich, R., Pellis, G., Ribeiro, A., Sartori, R., Torelli, L., BIGSETS Team, Source of the 1755 Lisbon Earthquake and Tsunami Investigated, EOS Trans. AGU, 82, pp 285-291. 2001.

Bathymetric map of the Gulf of Cadiz, NE Atlantic Ocean: The SWIM multibeam compilation

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1. Introduction

The Gulf of Cadiz, located at the convergent boundary between the European and African Plates, is characterized by a significant and widespread seismicity This area is also the source of the largest event occurred during historical times in Western Europe, the 1755 Lisbon Earthquake and Tsunami [1]. Since the 1990s the Gulf of Cadiz has been the subject of numerous geological and geophysical surveys, mainly based on multibeam, sidescan sonar, high-resolution and multichannel seismics, and sampling. The aim has been unravelling the complex geodynamic history of the Gulf of Cadiz, to characterize the deep structure, and to identify active tectonic sources in the region.
We focus on recently acquired multibeam data to present a new bathymetric compilation map.

2. Swath Bathymetric Data and Generation of a Digital Terrain Model (DTM)

The compilation of the deep multibeam bathymetric data in the Gulf of Cadiz include, as essential components, the 100 m grids acquired during the following cruises: TASYO-2000 PARSIFAL-2000, CADISAR-2001, HITS-2001, PICABIA-2003, MATESPRO-2004, CADISAR2-2004, DELILA-2004, DELSIS-2005, and SWIM2-2005.
Additional data on specific localities, has been provided by J.P. Henriet, G. De Alteriis teams, and SISMER database. The multibeam systems used to survey the seafloor are Simrad EM3000 and EM1000 for shallow areas, and Simrad EM300, EM12S, EM120 and Reson Seabat 8150 for intermediate to deep waters.

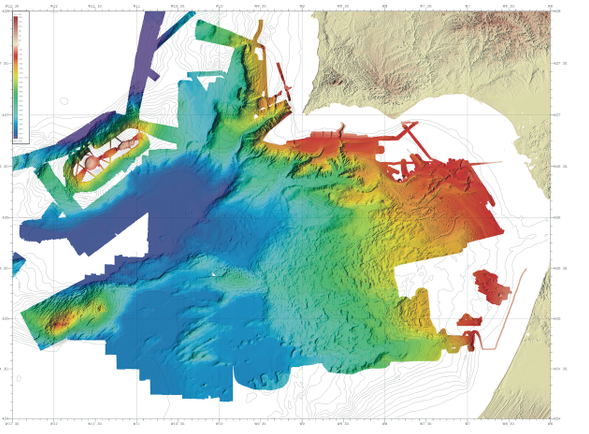

Figure 1. Bathymetric compilation map

The SWIM compilation includes data located in the area between 34ºN and 38ºN and between 12.5ºW and 5.5ºW (Fig. 1). For data processing and merging, we have used the CARAIBES system [2], a complete submarine mapping software developed by IFREMER to process data from multibeam echo-sounders (bathymetry and acoustic backscatter).

The main steps during data processing include quality control, validation and data filtering. After filtering, bathymetric data is interpolated at nodes of a regular-spacing grid in order to get a final DTM [3].

In the compilation map the swath bathymetric colour grid is overlaid by contours at 200-m interval from the "General bathymetric chart of the oceans" at 1 minute grid (1852 m) (GEBCO, 2004) [4]. For the land areas, we used digital grids released by the Seamless Shuttle Radar Topography Mission (SRTM-3) at 3 arc second interval (~90 m). Coastlines are extracted from the full-resolution GMT database.

3. Conclusions

The SWIM bathymetric compilation illustrates the main physiographic features of the Gulf of Cadiz, such as the talus, dominated by deeply incised submarine canyons; the central part dominated by faulted tectonic blocks (i.e. Marques de Pombal, Guadalquivir Bank) and mud volcanoes and diapirs of the accretionary wedge; and the oceanic external areas, comprising the Horseshoe Abyssal Plain and Gorringe Bank. The map reveals active morphostructures of tectonic, sedimentary and biogeochemical origin imprinted on the seafloor. In particular, this cartography allows us to identify seafloor ruptures of active faults, potential sources of large seismic events in the Gulf of Cadiz. The potential sources of the Great 1755 Lisbon Earthquake and Tsunami, i.e. Marques de Pombal, Horseshoe, and Pereira da Souza Faults, Guadalquivir Bank, and Gibraltar arc accretionary wedge [5-6-7-8-9-10], are included in this new bathymetric map, which will help to elucidate between the different tectonic sources suggested.

4. References

[1] Baptista, M.A., Miranda, P.M.A., Miranda, J.M., Mendes Victor, L., Constrains on the source of the 1755 Lisbon Tsunami inferred from numerical modelling of historical data, J. Geodynamics, 25, pp 159-174. 1998.

[2] Bourillet, J. F., Edy, C., Rambert, F., Satra, C. and Loubrieu, B., . Swath Mapping System Processing: Bathymetry and Cartograph, Marine Geophysical Researches, 18, 487-506. 1996.

[3] Diez, S., and Gràcia, E., Submarine Mapping using Multibeam Bathymetry and Acoustic Backscatter: Illuminating the Seafloor. Instrumentation Viewpoint, 3, Spring 2005, p. 10-14. 2005.

[4] GEBCO, 2004. Development of the GEBCO world Bathymetry grid, GEBCO website.

[5] Gutscher M.-A., J. Malod, J.-P. Rehault, I. Contrucci, F. Klingelhoefer, W. Spakman, L. Mendes-Victor,. Evidence for active subduction beneath Gibraltar? Geology; v. 30; no. 12; p. 1071–1074. 2002.

[6] Baptista, M.A., Miranda, J.M., Chierici, F., and Zitellini, N.. New study of the 1755 earthquake source based on multichannel seismic survey data and tsunami modeling. Natural Hazards and Earth System Sciences, 3, 333-340. 2003.

[7] Gràcia, E., Dañobeitia, J.J., Vergés, J., PARSIFAL, Mapping active faults offshore Portugal (36º-38ºN): Implications for seismic hazard assessment in the SW Iberian Margin, Geology 31, pp 83-86. 2003a.

[8] Terrinha, P., Pinheiro, L.M., Henriet, J.P., Matias, L., Ivanov, M.K., Monteiro, J.H., Akhmetzhanov, A., Volkonskaya, A., Cunha, T., Shaskin, P., Rovere, M, Tsunamigenic-seismogenic structures, neotectonics, sedimentary processes and slope instability on the southwest Portuguese Margin, Mar. Geol., 195(1-4), pp 55-73. 2003.

[9] Zitellini, N., Mendes, L.A., Cordoba, D., Danobeitia, J., Nicolich, R., Pellis, G., Ribeiro, A., Sartori, R., Torelli, L., and BIGSETS Team, Source of 1755 Lisbon Earthquake and Tsunami Investigated. EOS Trans. AGU, 82, Number 26. 2001.

[10] Zitellini, N., Rovere, M., Terrinha, P., Chierici, F., Matias, L., and BIGSETS Team, Neogene through Quaternary tectonic reactivation of SW Iberian Passive Margin. Pure Appl. Geophys., 161,565-587. 2004.