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Seafloor morphology of the Eurasia-Nubia (Africa) plate boundary between the Tore-Madeira Rise and the Straits of Gibraltar: a case of coexistent Mesozoic through Present day features of tectonic, oceanographic and sedimentary origin

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The joint use of more than 10.000 km multichannel seismic reflection profiles and 180.000km2 of multibeam swath bathymetry and backscatter allowed for a new vision of the seafloor tectonic and geomorphic processes of the area that encompasses the present day plate boundary between Africa and Eurasia, between the Gibraltar Straits and the Tore-Madeira Rise, in the southern sector of the North Atlantic Ocean.
The interpretation of this data allowed for the detailed description of the seafloor morphology (i.e. a morphologic map) and the classification of the morphologic features in what respects the genetic process and age.
It can be seen that in the same region coexist morphologic features that result from tectonic processes associated with the Triassic-Cretaceous break-up of Pangea, the Paleogene-Miocene compressive phase, the Miocene through Present subduction under the Gibraltar Arc (Gutscher et al., 2002), the Pliocene-Quaternary wrench tectonics and possible coeval plate boundary (Zitellini et al., 2009), the Present day mud volcanism and propagation of the compressive deformation along the West Continental Margin of Portugal (Terrinha et al., 2009). Interpretation of the seismic profiles together with the bathymetry allows the understanding of endogenous and exogenous processes that creates reliefs associated with active structures (related to the Miocene through Present compressive stress field). Other reliefs generated in Mesozoic times by analogous processes can be as well preserved as these active ones.
In what concerns exogenous processes, the analysis of the two datasets (reflection seismics and bathymetry) allowed for the description of morphologic features associated with oceanic currents that interact with the seafloor forming these important features. As is the case of the well known active contourites but also less known features, like giant scours at 4 km water depth that have recently been described, suggesting the interaction of deep currents and active tectonics (Duarte, in press). These features formed after the sealing of the Gulf of Cadiz Accretionary Wedge but the processes of their formation are an indication that at least some thrusts of this wedge are still active. The finding of buried scours in the Pliocene-Quaternary sediments indicates that the bottom currents have been active in the area at least since these times, i.e. after the opening of the Straits of Gibraltar.
The internal structure of the submarine canyons inspected in multichannel seismics also allowed for the identification of recurrent use of the S. Vincente canyon axis by paleo-drainage during the Late Miocene, Pliocene and Quaternary.
The identification of a 600 km long set of lineaments that may constitute the present day strike-slip plate boundary between Eurasia and Africa (Zitellini et al., 2009; Terrinha et al., 2009) between the northwestern Morocco shelf and the Gorringe-Hirondelle seamounts was made on inspection of multibeam bathymetry and seismic profiles. The thorough inspection of these data and cross interpretation with analogue modeling and mathematical analysis allowed speculation on the age of this tectono-morphic feature and its age. Furthermore, it is a clear demonstration that the identification of plate scale-like active tectonic features can be missed if the appropriated methods are not used.
Constrictive and releasing bends on the Gloria Fault and its connection with the Gorringe Bank and SWIM strike-slip Fault also allowed for the formation of penetrative fabrics associated with tectonic reactivations of

oceanic rift structures documented in this work.