

PROPEL cruise 2017 : understanding the Eurasia-Africa plate boundary in the Atlantic Ocean

Project Acronym & Title: PROPEL, Study of the propagation of the Eurasia-Africa plate boundary east of the Gloria fault

Area: Gloria fault, Josephine Seamount

Research Vessel: RV EXPLORA, OGS, Italy

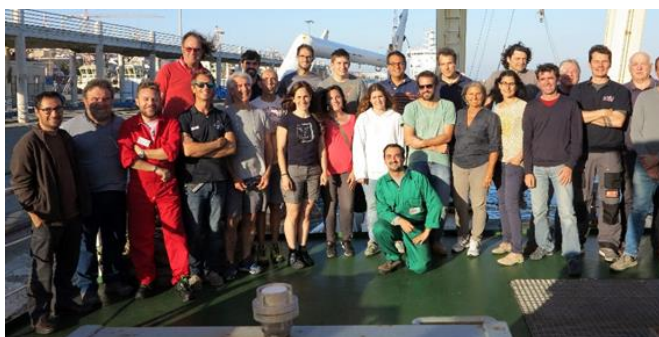
Chief scientist: Pedro Terrinha, Portuguese Institute for Sea and Atmosphere (IPMA)

Other project partners: Geomar-Kiel, CSIC-Barcelona, Fac. Ciências Univ. Lisboa, Univ. Hamburg, Univ. Bretagne Occidentale, Univ. Aveiro, Univ. Évora, ISMAR-Bologna

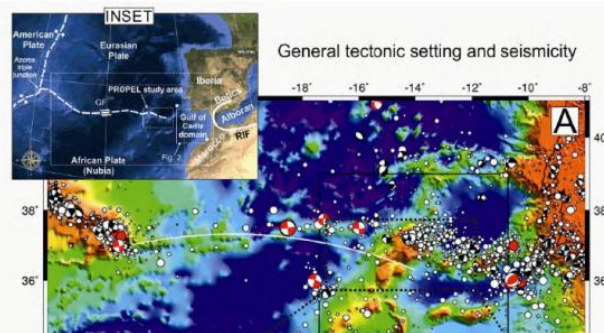
Date: 16 May-2 June 2017



RV OGS Explora

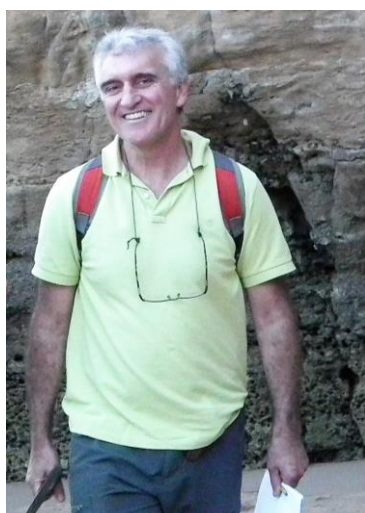


PROPEL research team



Pedro Terrinha, Portuguese Institute for the Sea and Atmosphere, Portugal

Understanding the Azores-Gibraltar Fracture Zone (AGFZ) has tantalized earth scientists for decades as it separates the lithospheric Eurasia and Africa plates from the times of formation of the Atlantic Ocean up until Present, when discussion about the closure of the Atlantic is at stake. The Azores-Gibraltar Fracture Zone also cuts across regions where instrumental and historical earthquakes up to magnitude 8.4 to 8.9 and large tsunami have occurred in the past (1941 and 1755 Lisbon earthquake). The PROPEL project aims at unraveling the tectonics of a segment of the AGFZ called the SWIMGLO connection, i.e. the connection of the SWIM and Gloria lithospheric faults that constitute the two main fault segments of the AGFZ. It was thus with great enthusiasm that the PROPEL and OGS Explora teams proceeded with the execution of this cruise and look forward to process and interpret the multichannel seismic reflection and magnetics dataset, which we already know are of high quality. The number of young researchers involved in the cruise (post-grad, phd and post-docs, 9 out of 12) guaranteed lively atmosphere and interest in the future outcome of this research.



Pedro Terrinha

Main objectives

The Gloria Fault is the oceanic fracture zone that marks the Eurasia-Africa plate boundary for more than 1300 km, from the Azores plateau to the Madeira-Tore Rise. The Gloria Fault produced an M8.4 earthquake in 1941 and two M>7 were produced in its vicinity in 1931 and 1975.

The 600 km long SWIM Fault has been attributed to the Eurasia-Africa plate transform boundary from the eastern termination of the Gloria Fault to the Gibraltar orogenic Arc, an area where instrumental earthquakes of M~7.9 (1969) and the historical 1755 Great Lisbon earthquake with estimated magnitude 8.3 to 8.9 have been generated.

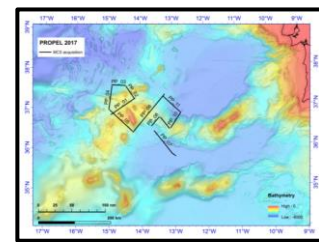
The Madeira-Tore Rise is a 1100 km long, >100 km wide, segment of over thickened oceanic crust that trends parallel to the Atlantic oceanic magnetic anomalies, across which the SWIM and Gloria lithospheric faults apparently do not cut across.

The main objective of the PROPEL cruise (PROPagation of the Eurasia-Africa pLate boundary East of the GLoria Fault) is to image the tectono-magmatic-stratigraphic structure of the SWIM Fault – Gloria Fault connection for better understanding the present, past and future tectonics of the Eurasia-Africa plate boundary in the Atlantic Ocean across the Madeira-Tore Rise and the natural hazards that can result from seismicity, volcanism and landslides.

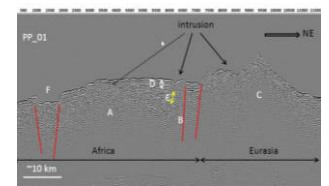
Work progress and main achievements

The more than 700km of high quality multichannel seismics, magnetic profiles and 2500 km of Chirp sub-bottom profiles allowed (with basic processing carried out onboard) imaging the structure of various geological features. Among these the following structures were imaged along the Eurasia-Africa plate boundary in the Atlantic, i) magmatic intrusions along the plate boundary (from ~90 My (MY= millions years) to 0.4 My), ii) plate boundary active faults, iii) large landslides and massive turbidites, iv) the Madeira-Tore Rise volcanic plateau. These features, due to their size, different origin and age and location with respect to the plate boundary, the Madeira-Tore Rise volcanic plateau and the Abyssal Plains allow us to have an idea of the various geological processes that occurred in this region from the time when the Pangea super-continent broke up in the Mesozoic, the oceanic spreading and the initiation of the Alpine mountain building and subduction in the Mediterranean realm.

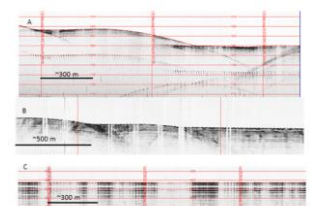
Hopefully these data will contribute to better understanding the plate kinematics in the Cretaceous, the Madeira ridge volcanism and the extent of very large mass transport deposits and their origin. This is also the first step towards a new vision of the tectonics of the deep North Atlantic along the Eurasia-Africa plate boundary where it intersects a major crustal lithospheric heterogeneity, the Madeira-Tore Rise. This volcanic ridge seems to have a volcanic plateau with recent volcanism probably very active since ~15My, making the oceanic crust much softer than the surrounding old lithosphere (~100 My). This has important implications to the understanding of the origin of large magnitude seismicity and propagation of subduction as it has been speculated in the past: is the Atlantic Ocean starting to close?



Map of the seismic profiles acquired during the PROPEL cruise. ©PROPEL team



PROPEL seismic profile #1 across the Eurasia-Africa plate boundary. The boundary is sharp and discrete hosting a magmatic intrusion.



Sub-bottom profiles acquired during the PROPEL cruise. Red horizontal lines equidistant 25m. ©PROPEL team.

For more information: <Other useful links, such as other linked programs/projects, etc>