OBJECTIVES:

An integrative study of the Tore submarine structure will allow testing several oceanographic, sedimentological and geochemical processes, in a tectonic active context, which are often difficult to deconvolve in the open oceanic realm as several variables simultaneously, influence the sediment record.

We therefore aim to accomplish the following list of innovative scientific objectives by coring the Tore basin:

1. Investigate the role of baroclinic tides and internal waves in mixing the water inside the 120 km wide crater-like basin, or the formation, deviation and possible entrance of Mediterranean-eddies through the Tore narrow gate.
Existing CTDs and planned water-signal seismic profiles inside and outside the Tore will track changes and the extent of water masses density and eddies; the interaction of currents and topography will be modelled; and the hypothesis of deep water ventilation associated with geothermal heat will be tested. All these results will serve as present-day analogues for major application to past regional ocean circulation and sediment motion and processes, in the sediment sequence of the proposed coring site.

2. Estimate the total hemipelagic vertical flux collected in the subtropical open ocean. The Tore Seamount basin traps biogenic and detrital particles derived from organisms thriving in the mid-Atlantic subtropical surface waters, distal Iberian continental advected phytoplankton plumes, perhaps local upwelling-induced by the seamount itself, and wind-driven pollen and dust particles from neighbouring Iberia and the Saharan regions. The Tore basin has the additional advantage of preserving the total ocean-bottom particle flux accumulated in this confined environment, without recirculation or addition of bottom flux by bottom currents transport.

3. Deconvolve, in a natural laboratory, isolated paleoceanographic processes away from a complex oceanic system (e.g. tackle the preservation of bottom carbonate sediment influenced by different bottom waters); estimate the orbital and millennial-scale effect of the AMOC changes in the Tore basin ventilation and export productivity; verify if millennial-scale cold climate conditions favoured anoxia (with organic rich layers formation).

4. Disentangle, in an in-situ laboratory, individual sedimentological processes from the intricate continental margin system In the Tore basin downslope currents, like turbiditic and debris-flows, operate exclusively without interference of alongslope currents; relevance of sea level variation impact as trigger mechanism for generation of gravitational transport; climate control in frequency of turbidites.

5. Investigate the linkage between deep geological and shallow oceanographic processes. Based on preliminary data suggesting the occurrence of active fluid flow structures, an extensive pore fluid geochemistry study will find out about deep-sourced fluid-rock interactions, and fluid transport mechanisms. In parallel, the organic geochemistry of the sediments and interstitial fluids and gases will reveal if, and to what extent, abiotic fluid-rock interactions in the sub-seafloor sustain the development of extreme microbial ecosystems, in particular with respect to methane generation and oxidation.

The proposed framework will allow achieving innovative scientific approaches that we expect will lead to a successful improvement of knowledge beyond the current state-of-the-art.