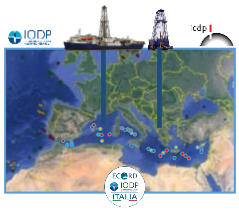

Workshop IODP-Italia "Lo stato delle proposte di perforazione nell'area mediterranea"
Scientific Drilling in the Mediterranean Sea
Roma, 15-16 gennaio 2018

Abstract

Le perforazioni scientifiche mediterranee nella storia recente

Tyrrhen**I**an **M**agmatism & Mantle **E**xhumation (**TIME**)

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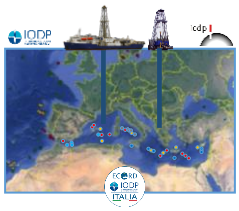
Abstract

The "TyrrhenIan Magmatism & Mantle Exhumation" (TIME) project is focused on the youngest basin of the Western Mediterranean, formed from Upper Tortonian to recent by continental extension in a back-arc setting, during rollback of the ESE-SE migrating Apennine subduction system. Recent geophysical surveys (Fig.1) combining wide-angle seismic (WAS), gravity and multichannel seismic (MCS) reflection data strongly support the presence of magmatic rocks formed during the early rifting phase, and of partially serpentinized peridotites, presumably corresponding to subsequently exhumed mantle, occupying the center of the basin.

Since the discovery by drilling that the COT of the West Iberia Margin is characterized by large exposures of exhumed mantle peridotite forming the basement next to the continental crust, the model has been applied to interpret many other continental margins in the absence of sampling of the crystalline crust. However the processes that govern peridotite exhumation without significant magmatism are not well understood. To explain it, two main hypotheses have been proposed: (1) Slow extension rates, so that the asthenosphere cools during ascent and no melting occurs; and (2) The mantle was originally too depleted to significantly further melt. There is also an ongoing debate on whether mantle exhumation in West Iberia (and elsewhere) may actually be related to slow or ultraslow seafloor spreading, rather than representing rifting. Additionally, the transition to normal seafloor spreading after mantle exhumation, as in Atlantic non-volcanic type of margins, is not well constrained. A fundamental issue to understand the suite of processes is the scarcity of basement samples in this type of rift systems, and the limited number of modern seismic experiments.

Recent geophysical surveys carried out in the Tyrrhenian basin combining wide-angle seismic (WAS), gravity and multichannel seismic (MCS) reflection data is challenging this conceptual model which assumes the presence of a classical-type continental margin with thinned continental crust in the margin juxtaposed to oceanic crust in the deep central basins. Conversely, the new data support the presence of oceanic-type magmatic rocks where crust was previously assumed to be continental, and of partially serpentinized peridotites where crust was previously inferred to be oceanic crust. The exhumed mantle occupies the center of the basin, and was later intruded by renewed basaltic fissural magmatism. This interpretation is consistent with early drilling results, but an appropriate conceptual model that explains the early magmatic phase and the later amagmatic mantle exhumation, apparently at fast opening rates, is at odds with current conventional wisdom.



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Drilling the Tyrrhenian is a unique opportunity to assess the validity of current end-member models. The basin is young and covered by a relatively thin sediment layer, which facilitates reaching basement in multiple locations. The database available to design the drilling project is possibly one of the best from any rifted basin. The basement has been dredged at highs and drilled in several campaigns, and the stratigraphy is reasonably well known from three drilling expeditions, DSDP leg 13, DSPD leg 42 and the ODP leg 107. In addition, a full coverage high-resolution multibeam bathymetry helps the 3D interpretation of a large data set of vintage and modern 2D MCS reflection profiles and seven regional wide-angle seismic transects of the basin.

In synthesis the main objectives of the TIME research program are: to determine the kinematics and geometry in space and time of the extensional deformation in the basin; to establish the timing and origin of the associated magmatism; to establish the rheology, deformation patterns and timing of mantle exhumation; to determine the compositional evolution and heterogeneity of the mantle source; to test current models of continental lithosphere rifting and of COT formation.

Abstract

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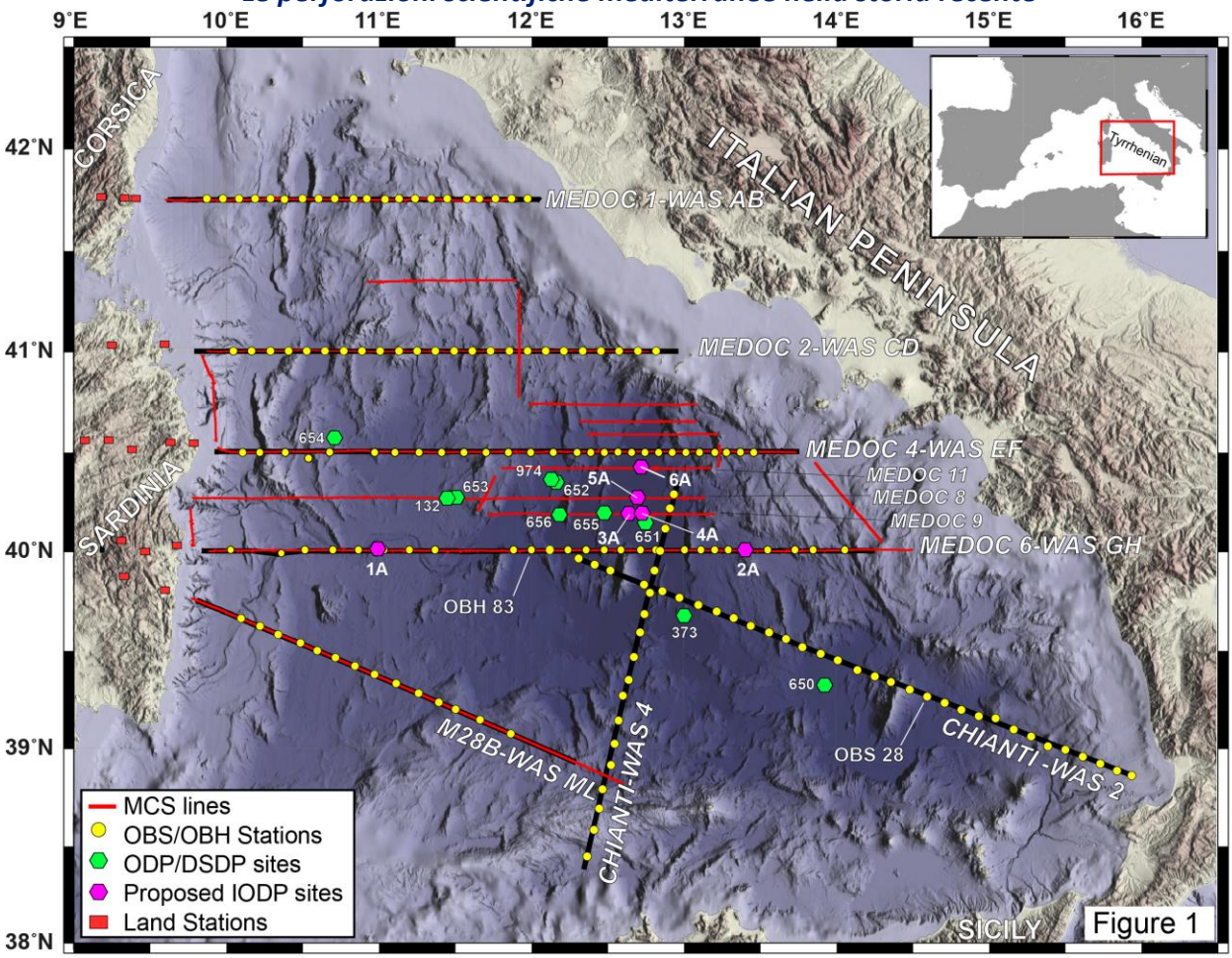

Fig.1 Bathymetric and topographic map of the Tyrrhenian region. Bathymetric data are downloaded from EMODnet portal (http://portal.emodnet-bathymetry.eu/gebco-bathymetry-basemap), while topographic data are part of 90m-SRTM dataset freely downloaded by web. Black thick and red lines depict respectively the WAS and MCS transects acquired during the MEDOC and CHIANTI experiment. Locations of OBS, and OBHs used to acquire WAS data are indicated by yellow circles while land stations are shown in red. Green polygons show the location of ODP and DSDP sites sampled in the seventies and while pink polygons depict the location of the proposed IODP sites TYR-1A to TYR-6A.