

# IODP Proposal Cover Sheet

927 - Pre

Tyrrhenian Continent-Ocean Transition

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| Title      | Tyrrhenian Magmatism & Mantle Exhumation   |      |                |
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| Keywords   | mantle exhumation, continental lithosphere rifting   | Area | Tyrrhenian Sea |

## Proponent Information

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|-------------|--|
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## Abstract

The objective of The "Tyrrhenian Magmatism & Mantle Exhumation" (TIME) project is to study the nature of the unconventional continent-ocean transition (COT) from continental rifting to robust magmatism and subsequent mantle exhumation and closely time-related magmatism. This objective includes studying the kinematics of the opening, the nature and timing of associated magmatism and the geochemistry and deformation of the exhumed mantle section.

The TIME project is focused in 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 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. The youth of the basin results in a modest sediment covers making feasible to sample, with unprecedented lateral resolution, the peridotitic/magmatic basement across the conjugated margins of the basin.

The database available to design the drilling project is possibly one of the best from a rifted basin. The basement of the Tyrrhenian basin has been dredged at highs 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 (Fig.1). In addition, a full-coverage high-resolution multibeam bathymetry of the basin helps the 3D interpretation of a large data set of vintage and modern 2D MCS reflection profiles. More geophysical data are planned to be acquired in the forthcoming months to further characterize the structure and the nature of the mantle.

### Scientific Objectives

- 1) to determine the kinematics and geometry in space and time of the extensional deformation in the basin;
- 2) to establish the timing and origin of the associated magmatism;
- 3) to establish the rheology, deformation patterns and timing of mantle exhumation;
- 4) to determine the compositional evolution and heterogeneity of the mantle source;
- 5) to test current models of continental lithosphere rifting and of COT formation.

Non-standard measurements technology needed to achieve the proposed scientific objectives

## Proposed Sites (Total proposed sites: 12; pri: 6; alt: 6; N/S: 0)

| Site Name              | Position<br>(Lat, Lon) | Water<br>Depth<br>(m) | Penetration (m) |     |       | Brief Site-specific Objectives                               |
|------------------------|------------------------|-----------------------|-----------------|-----|-------|--|
|                        |                        |                       | Sed             | Bsm | Total |  |
| TYR-01A<br>(Primary)   | 40.01745<br>10.9984    | 2675                  | 286             | 50  | 336   | The basement of the Cornaglia Terrace                        |
| TYR-02A<br>(Primary)   | 40.00036<br>13.40327   | 2813                  | 652             | 50  | 702   | The basement of the Campania Terrace                         |
| TYR-03A<br>(Primary)   | 40.18388<br>12.6413    | 3533                  | 356             | 50  | 406   | The serpentinized mantle peridotite                          |
| TYR-04A<br>(Primary)   | 40.18402<br>12.72801   | 3546                  | 773             | 50  | 823   | The serpentinized mantle peridotites                         |
| TYR-05A<br>(Primary)   | 40.26609<br>12.69432   | 3530                  | 142             | 200 | 342   | The serpentinized mantle peridotite                          |
| TYR-06A<br>(Primary)   | 40.41593<br>12.72474   | 3592                  | 902             | 50  | 952   | The serpentinized mantle peridotite                          |
| TYR-07A<br>(Alternate) | 40.00097<br>10.98619   | 2700                  | 286             | 50  | 336   | Same target of TYR-01A, the basement of Cornaglia Terrace    |
| TYR-08A<br>(Alternate) | 40.00036<br>13.39599   | 2837                  | 548             | 50  | 598   | Same target of TYR-02A, the Campania Terrace basement rocks  |
| TYR-09A<br>(Alternate) | 40.18939<br>12.63243   | 3533                  | 450             | 50  | 500   | Same target of TYR-03A, the serpentinized mantle peridotite. |
| TYR-10A<br>(Alternate) | 40.18398<br>12.70826   | 3544                  | 591             | 50  | 641   | Same target of TYR-04A, serpentinized mantle peridotite.     |
| TYR-11A<br>(Alternate) | 40.26614<br>12.70529   | 3538                  | 327             | 200 | 527   | Same target of TYR-05A, serpentinized mantle peridotites     |
| TYR-12A<br>(Alternate) | 40.4159<br>12.7076     | 3590                  | 1057            | 50  | 1107  | Same target of TYR-06A, serpentinized mantle peridotites     |