

IODP Proposal Cover Sheet

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Tyrrhenian Continent-Ocean Transition

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Title	Tyrrhenian Magmatism & Mantle Exhumation		
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Proponent Information

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