



Rifting in the Northern Tyrrhenian Sea: Results from a combined wide-angle and multichannel seismic study

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Extension in the continental lithosphere leads to the formation of rift basins or finally to passive continental margins where plates fully broke apart. The extensional processes at basins and passive margins are still not fully understood. One of the reasons is that the observed amount of crustal thinning is often much higher than the horizontal extension in the brittle upper crust that can be accounted by faulting. Moreover, conjugated margins are often observed to be asymmetric in tectonic style. Regarding these objective we present an analysis of two W-E striking multichannel- and wide-angle seismic sections from the Northern Tyrrhenian Sea. The new data were acquired onboard the Spanish R/V Sarmiento de Gamboa and Italian R/V Urania in spring 2010, within the framework of the MEDOC project. The lines cross the basin from the Corsica and Sardinia Margins towards the conjugated Latium and Campania Margins (Italy). The transects are divided in four zones distinguishable in tectonic style, velocity distribution, heat-flow and crustal thickness: 1) The deep sedimentary Corsica and Sardinia basins in the West which formed during Oligocene (~ 30 Ma) and reveal a fan-shaped sedimentary infill that is sealed by a Messinian erosional unconformity on top ($\sim 5-7$ Ma). 2) Large rotated blocks bounding the deepest sub-basins along the entire transects and contain Messinian syn-tectonic sediments. 3) A zone of highly fractured continental crust broadens to the south and is indicated by a high number of faults and coincident with a velocity reduction. Furthermore, magmatic activity during Pliocene age in the southern line is evident in the southern line. 4) Flat summits at the Latium Margin indicate that this zone was above seal-level during rifting whereas the southern region was sub-sealevel. Faults cutting the seafloor indicate recent tectonic activity.

To quantify the amount of horizontal extension we identified pre-, syn-, and post-tectonic sedimentary units in the northern line, calculated the relative extension factor by large faults as well as balancing the length of the pre-tectonic basement. The Messinian reflector can be well identified throughout both sections and is therefore an excellent time-marker within the syn-tectonic sequence. The syn-tectonic sequence is limited by a reflector of Pliocene age. The above lying Pleistocene to Quaternary sediment is undisturbed and identified as the post-tectonic sequence except for the eastern region to the South (CD-line). Tomography of first arrivals obtained from wide-angle seismic data reveals the crustal architecture and thickness of $17 \text{ km} \pm 1 \text{ km}$ along the northern profile. We found that the crust east of the Corsica Basin towards the Latium Margin is horizontally stretched by $\sim 30\%$ and thinned vertically by the same amount (β -factor=1.3). Along the MEDOC-CD line the crustal has thinned by a factor of 1.5 in the vicinity of the Sardinia Basin and thins to a maximum of 2.2 (11 km) towards the mainland of Italy. Whereas the northern region has apparently stretched symmetrically, the higher stretched southern transect builds a pair of asymmetric conjugated margins.