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The Tyrrhenian Basin formation: from continental rifting to seafloor spreading, followed by mantle exhumation and late fissural volcanism.

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We present a new interpretation of the configuration of the geological domains and the processes of rifting forming the Tyrrhenian basin based on newly acquired geophysical data. The basin is not presently extending, but its crustal structure preserves information of the temporal evolution of rifting processes.

We present P-wave velocity (Vp) models and seismic reflection images of data collected in a two-ship seismic experiment with Spanish R/V Sarmiento de Gamboa and the Italian R/V Urania carried out in spring 2010. We present five several-hundred-km-long wide-angle seismic (WAS) profiles crossing the entire basin at different transects and five Multichannel Seismic Reflection (MCS) profiles coincident with WAS profiles.

The 5 transects provide the tectonic structure, the geometry of sedimentary deposits, and the Vp distribution of the crust and upper mantle. This information allows to interpret mechanisms of deformation, define the petrological nature and distribution of the geological domains, infer the importance and potential role of magmatism in the rifting process, and constrain the location of break up and the region of mantle exhumation.

The basin has opened from north to south with different extension factors. The northern region stopped opening after a relatively low extension factors, but towards the south extension increased up to full crustal separation that produced first abundant magmatism and subsequently mantle exhumation in another region. Later fissural volcanism followed producing large volcanic ridges and tall seamounts. This sequence of events and the resulting configuration is in stark contrast with predictions based on conventional models of back-arc spreading.