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# The Tyrrhenian Basin: fault activity migration, focusing of deformation, break up, magmatism and fast mantle exhumation

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We present a new interpretation of the creation of the geological domains and the processes forming the Tyrrhenian basin by rifting of Cratonic Variscan lithosphere. The basin is not presently extending, but its crustal structure preserves information of the temporal evolution of rifting processes.

Our work is based on the tectonic structure and stratigraphy of over 3000 km of calibrated multichannel seismic data and full coverage multibeam bathymetry of the basin. From these data circa 2000 km are new and about 1000 are vintage data. The seismic data are used to understand the formation of the domains (continental, backarc magmatism, exhumed mantle) defined with our recently published, under review, or submitted 5 across-the-basin wide-angle reflection and refraction transects. The 5 transects provide the Vp distribution of the crust and upper mantle. This information has allowed defining the petrological nature and distribution of the geological domains, and to infer the importance of magmatism in the rifting process, to constrain the location of break up and the expanse of the region of mantle exhumation.

The seismic reflection images have been interpreted to map in time and space the evolution of the deformation across the basin. We analyzed the tectonic structure and mapped the calibrated stratigraphy across the basin to understand the temporal evolution and styles of faulting processes. The stratigraphy provides also constraints on the rates at which the different processes of extension, magmatism, break up and mantle exhumation have occurred.

The basin has opened with different extension factors from north to south. The northern region stopped opening after a relatively low extension factors. Towards the south extension increased up to full crustal separation. Here extension in some areas was coeval with abundant magmatism. Changing in the locus of faulting and rates of extension led to break up and to a surprisingly fast mantle exhumation. Subsequent fissural large-scale extrusive volcanism produced volcanic ridges and tall seamounts. The sequence of events, the rates at which the events occurred, and the resulting configuration of geological domains in the basin, are all in contrast with conventional models of rifting of continental lithosphere and melting of asthenosphere.