



Using the salt tectonics as a proxy to reveal post-rift active crustal tectonics: The example of the Eastern Sardinian margin

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The Western Tyrrhenian Basin, Mediterranean Sea, is a fascinating basin in terms of interactions between crustal tectonics, salt tectonics and sedimentation. The METYSS (Messinian Event in the Tyrrhenian from Seismic Study) project is based on 2100 km of HR seismic data acquired in 2009 and 2011 along the Eastern Sardinian margin. The main aim is to study the Messinian Salinity Crisis (MSC) in the Western Tyrrhenian Basin, but we also investigate the thinning processes of the continental crust and the timing of crustal vertical motions across this complex domain. Our first results allowed us to map the MSC seismic markers and to better constrain the timing of the rifting, which ended before the MSC across the upper and middle parts of the margin. We also evidenced that crustal activity persisted long after the end of rifting. This has been particularly observed on the upper margin, where several normal faults and a surprising compressional structure were recently active.

In this study we investigate the middle margin, the Cornaglia Terrace, where the Mobile Unit (MU, mobile Messinian salt) accumulated during the MSC and acts as a décollement. Our goal is to ascertain whether or not crustal tectonics existed after the pre-MSC rift. This is a challenge where the MU is thick, because potential basement deformations could be first accommodated by the MU and therefore would not find any expression in the supra-salt layers (Upper Unit, UU and Plio-Quaternary, PQ).

However our investigations clearly reveal interactions between crustal and salt tectonics along the margin. We thus evidence gravity gliding of the salt and its brittle sedimentary cover along basement slopes generated by the post-MSC tilting of some basement blocks bounded by crustal normal faults, formerly due to the rifting.

Another intriguing structure also got our interest. It corresponds to a wedge-shaped of MU located in a narrow N-S half graben bounded to the west by a major, east-verging, crustal normal fault. Below the MU, the sediments thicken toward the fault. The top of the MU is sub-horizontal and the supra-salt layers are sub-horizontal. At a first glance this geometry would suggest that the pre-salt unit and the MU are syn-tectonic and that nothing happened after Messinian times. However some subtle evidence of deformations in the UU and PQ (an anticline to the west and a small west-verging normal fault in the east) imply that some crustal tectonics activity persisted after the end of the rifting. To understand why the salt unit is wedge-shaped, we considered several scenarii that we tested with physical modelling. We demonstrate that this structure is related to the post-rift activity of the major crustal normal fault, whose vertical motion has been cushioned by lateral flow of an initially tabular salt layer, which thinned upslope and inflated downslope, keeping the overlying sediments remained sub-horizontal.

Such interactions between thin-skinned and thick-skinned tectonics highlight how the analysis of the salt tectonics is a powerful tool to reveal recent deep crustal tectonics in the Western Mediterranean Basin.