



Interactions between crustal tectonics and salt tectonics along the Eastern Sardinian margin: Using the salt tectonics as a proxy to reveal recent crustal tectonics

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The Tyrrhenian Basin represents the youngest stage of a long complex history of backarc extension that led to the opening of the Western Mediterranean Basin. Rifting of the Eastern Sardinian margin, Western Tyrrhenian Sea, and subsequent sea-floor spreading occurred from the Late Miocene to present-day. In addition, a major palaeo-environmental crisis, the Messinian Salinity Crisis (MSC), occurred in the whole Mediterranean Basin from 5.97 to 5.33 Ma, during the lithospheric extensional period. Among many consequences, the MSC led to the accumulation of a thick evaporitic sequence along the Eastern Sardinian Margin. This sequence includes a mobile salt layer (the Mobile Unit, MU) made of halite, which deforms ductily and acts as a décollement. The Western Tyrrhenian Basin is thus a fascinating basin in terms of interactions between crustal tectonics, salt tectonics and sedimentation.

The METYSS project (Messinian Event in the Tyrrhenian from Seismic Study) aims to investigate the MSC, the thinning processes of the continental crust and the timing of crustal vertical motions across the Eastern Sardinian margin. Our first published results (Gaullier et al., 2014; Lymer et al, in press), based on 2100 km of high-resolution seismic data acquired in 2009 and 2011, have allowed to determine that the rifting ended before the MSC across this backarc domain, but that a surprising crustal activity has persisted across the proximal margin during the Pliocene, locally up to recent Quaternary times. These crustal post-rift deformations involved both extensional and compressional structures and were particularly observed on the proximal margin, where the salt layer is thin or absent.

In this study we investigate the salt tectonics in the deeper margin, i.e. the Cornaglia Terrace, where the MU accumulated during the MSC. Our goal is to test if post-MSC crustal tectonics also persisted across the distal margin. This is a challenge where the MU is thick, because potential basement deformation could be partly or totally accommodated by lateral or vertical flow of the salt and therefore would not be transmitted into the supra-salt layers (Upper Unit and Plio-Quaternary). Our investigations clearly reveal interactions between crustal and salt tectonics along the margin, which imply that some crustal tectonics activity persisted after the end of the rifting. We then illustrate examples of different responses of the salt and its overburden to sub-salt crustal movements along the Eastern Sardinia margin, supported with results from analogue modelling experiments. Particularly, these models were crucial to demonstrate how crustal vertical motion have 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.