

Messinian post-evaporitic paleogeography of the Po Plain-Adriatic region by 3D numerical modeling: implications for the Central Mediterranean desiccation during the MSC

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In the last decades the Messinian Salinity Crisis (MSC) has been the topic of a number of studies, in particular in onshore areas, as they offer a unique opportunity to analyze the controlling factors and the geological consequences of the estimated 1.5 km sea-level drop. During the MSC, the geometry of western and eastern sides of the Mediterranean basin was similar to the present day basin while, important changes took place in the central portion as a consequence of the (still ongoing) tectonic activity of the Apennine domain. Recent high-resolution 2D seismo-stratigraphic and 1D backstripping analysis by Eni E&P group described a step-wise sea-level lowering during evaporitic and post-evaporitic MSC phases in the Po Plain-Northern Adriatic foreland (PPAF), with a sea-level drop not exceeding 900 m.

Thanks to a dense grid of 2D seismic profiles, integrated with ca. 200 well logs (confidential data, courtesy of ENI E&P), a 3D reconstruction of the entire northern PPAF basin geometry and the facies distribution during the Latest Messinian time has been carried out.

In this study, we performed a 3D backstripping and lithospheric scale uplift calculations of the northern PPAF basin testing the 800-900m of sea-level draw down. The resulted restored Latest Messinian paleotopography (corresponding to the bottom Pliocene in the most of the study area) and related shoreline position, strongly fit with the recentmost continental/marine facies distribution maps. The latest Messinian morphology shows deep marine basins persisting during the entire MSC period, filled by clastic turbiditic sediments and a wide emerged area along the Southern Alps margin and Friulian-Venetian basin.

A 3D reconstruction of the Latest Messinian surface shows peculiar river incisions along the Southern Alps margin; these V-shape canyons perfectly fit with the present day fluvial network, dating back the drainage origin at least at the Messinian acme.

Moreover, if in a well-constrained marginal region (i.e PPAF) of the Mediterranean basin a lower sea-level drop is recorded, the heterogeneous Adriatic morphology controlled the connection/isolation with the rest of the Mediterranean water body, and previous models can still be locally valid.

During Messinian time the central Mediterranean was characterized by the Adriatic basin made by an almost undeformed foreland margin to the east, by the Apennine chain and emerged/shallow carbonate platforms to the west.

In this view the alternation of deep and shallow basins, the consequent basement vertical motions due to different sediment loading and the sea-level fall are all factors that played fundamental roles during MSC, possibly isolating marine portions that experienced different sea-level variation and facies deposition due to a local runoff/evaporation equilibrium.