Flexural-isostatic reconstruction of the Western Mediterranean vertical motions after the Messinian Salinity Crisis: implications for sea level and basin connectivity

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The Messinian Salinity Crisis was a period of rapid and extreme environmental change in the Mediterranean occurring from 5.96 to 5.33 Ma, leading to deposition of a huge amount of evaporites in the deep basins and erosion on the margins. Erosional surfaces located deep below current sea level suggest a kilometric drop in sea level commonly associated with the deposition of massive halite deposits during the crisis. However, the timing and magnitude of this sea level drawdown are not well constrained in spite of its important implications for the conditions under which the different MSC sedimentary units were deposited and the connectivity of various sub-basins during the crisis. A 2D (planform) flexural backstripping allows us to restore the Messinian topography in tectonically quiescent areas, constraining the isostatic subsidence due to the (post)Messinian sediment, and the potential effect of falling sea level during the crisis. In this way we restore the elevation of paleoshorelines and the original depth of erosional surfaces and other stratigraphic markers. We apply this method to the area spanning the Valencia Basin, Balearic Promontory and the Algero-Provençal Basin, to restore the Messinian Erosion Surfaces which formed subaerially during the drawdown to their original depth, constraining the minimum base level drop required to erode the margins at these locations. We reconstruct three key moments in the basin history: the pre-crisis basin, the end of halite deposition, and the end of the crisis. We consider multiple scenarios in terms of timing of sea level fall. Preliminary results indicate that over 1 km of sea level drop is required at the end of the Messinian, and over 2 km at the crisis acme to reproduce the observed location of the paleoshorelines, with only small sensitivity to crustal strength. This is in good agreement with estimates from previous backstripping investigations, and provides constraints on the progression of the MSC in the Western Mediterranean.