Seamount Control during Gravity-Driven Extension Involving Multi-Layered Evaporites

Oriol Ferrer[1], Eduard Roca[1], Oscar Gratacós[1], and Josep Anton Muñoz[1]

[1]University of Barcelona, Barcelona, Spain

Abstract

The Liguro-Provençal basin (Western Mediterranean) includes a thick multi-layered salt sequence composed by three evaporitic units (Lower, Mobile and Upper units) deposited in the deep basin during the Messinian salinity crisis (Upper Miocene). From these units, the Mobile unit (MU), formed by halite, is the weakest layer acting as an extensional detachment. It favoured the downslope gravitational failure of the overlying sediments controlling the structural style of this region. As a result, two different salt tectonics domains have been classically interpreted: an upper extensional domain characterized by basinward-dipping listric normal faults that sole into the MU, and a downdip contractional domain that accommodates the updip extension by folding, salt inflation or diapir squeezing. The base of the MU does not show significant regional topographic variations and is characterized by a gentle surface dipping basinward. However, several seamounts located in the upper extensional domain disrupt this surface constraining the salt flow. They developed previously to the salt deposition and are organized along a chain with a NNE-SSW trend. The seamounts acted as a passive buttress during the gravitational failure and developed a characteristic set of structures depending on their size, height and orientation. Listric faults dipping downslope developed in the seamount basinward flank when the MU is thicker than the height of the seamount. In this case, the upslope extension is accommodated in the landward flank of the seamount by salt inflation. Conversely, when the seamount is higher than the MU thickness, the buttressing produced by the seamount generated contractional structures in its landward flank. Different relay structures developed between these two cases. Using an experimental approach (sandbox models), this research analyses the role played by a volcanic chain in the upslope extensional domain of a passive margin including multi-layered post-rift evaporites. We characterize the internal deformation of the evaporites in response to these seamounts and how their orientation, shape and height constraint the development of extensional structures and the salt flow. The results of this experimental program are compared with a 2D seismic survey of the Liguro-Provençal basin suggesting a possible 3D structural evolution for the area.