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# Shale Tectonics Processes in the West Alboran Sea

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The Alboran Sea in the Mediterranean is a back-arc basin developed during the Miocene by extensional collapse within the arc-shaped orogen formed by the Betics in S Spain and the Rif in N Morocco. A major depocenter (>10 km) is located in the western part of the basin (West Alboran Basin, WAB) and contains a diapiric province with overpressured shales and mud volcanoes. Seismic and well data are used to analyze the evolution of the shale structures in the northern margin of the WAB.

We present a re-evaluation of the shale structures in the basin based on the knowledge derived from the salt-tectonics practice in basins with mobile layers.

Shale structures in this margin of the WAB are detached along the basement-cover surface. From landward to seaward, the structural style of the deformed Miocene sedimentary sequence shifts from marginal growth faults and rollovers, to shale-cored anticlines, to pinched-off geometries surrounded by open shale minibasins, and finally to shale-cored thrusts. A selected regional dip seismic section situated close to the eastern end of the shale province has been restored to evaluate the magnitude and timing of the deformation.

The restoration reveals continuous contractional deformation since the deposition of the shales in the Early Miocene. The estimated total shortening is approximately 70%. Peak shortening occurred during a major contractional event in the Upper Miocene (from ca. 7.5 Ma, upper Tortonian to Messinian). The magnitude and timing of the updip extensional faulting is insufficient to balance the shortening magnitude. We therefore conclude that the main mechanism to promote the shale structures, rather than the downslope migration and gliding of the overpressured shales, is the persistent contractional deformation of the basin promoted by basement thrusting towards the Betics. A continuous reduction of the shale volume through the Miocene-to-Recent deformation is also found, with a significant out-of-plane shale evacuation that coincided with the main contractional pulse.

This new interpretation indicates that shortening was a major triggering factor for overpressure and mud volcanism in the WAB. It also helps to explain the differences between shale structures and those shaped by salt tectonics.