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Late-Variscan Tectonic Inheritance and Salt Tectonics Interplay in the Central Lusitanian Basin

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Tectonic inheritance and salt structures can play an important role in the tectono-sedimentary evolution of basins. The Alpine regional stress field in west Iberia had a horizontal maximum compressive stress striking approximately NNW-SSE, related to the Late Miocene inversion event. However, this stress field cannot produce a great deal of the observed and mapped structures in the Lusitanian Basin. Moreover, many observed structures show a trend similar to well-known basement fault systems. The Central Lusitanian basin shows an interesting tectonic structure, the Montejunto structure, generally assigned to this inversion event.

Therefore, special attention was paid to: (1) basement control of important observed structures; and (2) diapir tectonics (vertical maximum compressive stress), which can be responsible for significant vertical movements.

Based on fieldwork, tectonic analysis and interpretation of geological maps (Portuguese Geological Survey, 1:50000 scale) and geophysical data, our work shows: (1) the Montejunto structure is a composite structure comprising an antiform with a curved hinge and middle Jurassic core, and bounding main faults; (2) the antiform can be divided into three main segments: (i) a northern segment with NNE-SSW trend showing W-dipping bedding bounded at the eastern border by a NNE-SSW striking fault, (ii) a curved central segment, showing the highest topography, with a middle Jurassic core and radial dipping bedding, (iii) a western segment with ENE-WSW trend comprising an antiform with a steeper northern limb and periclinal termination towards WSW, bounded to the south by ENE-WSW reverse faulting, (3) both fold and fault trends at the northern and western segments are parallel to well-known basement faults related to late-Variscan strike-slip systems with NNE-SSW and ENE-WSW trends; (4) given the orientation of Alpine maximum compressive stress, the northern segment border fault should be mostly sinistral strike-slip and the western segment border fault should be a pure thrust; (5) uplift along the northern and central segments may point out to the presence of a salt diapir at depth, aiding vertical movement and local uplift of the structure; (6) geometry of seismic units of the neighboring basins is consistent with halokinesis related to the antiform growth during the Jurassic; (7) sedimentary filling of the neighbouring basins shows relationship to antiform development and growth into a structural high before the Late Miocene Alpine event.

These data suggest that: (1) pre-existing basement faults and their reactivation played important role on the development of Montejunto complex tectonic structure; (2) important vertical movements occurred as the result of regional and local (diapir) tectonics; (3) subsidence in neighbouring basins may have promoted maturation, and possible targets with strong potential for hydrocarbon trapping and accumulation may have also developed; (4) diapir tectonics initiated before the Cretaceous; (5) given the topography, and the geometry and inferred kinematics of all segments, it seems that the Montejunto structure formed in a restraining bend controlled by inherited late-Variscan basement faults.