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

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ABSTRACT

Salt structures and tectonic inheritance 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 many of the observed and mapped structures in the onshore Lusitanian Basin. 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 of Meso-Cenozoic cover rocks. Based on fieldwork, tectonic analysis and interpretation of geological maps (Portuguese Geological Survey, 1:50000 scale) and geophysical data, our work shows: (1) the presence of high angle faults and anticlines with N-S, NNE-SSW, ENE-WSW or WNW-ESE trends, unconformities and folded unconformities, which cannot be the result of Alpine compression; (2) most salt structures show NNE-SSW and ENE-WSW trends; (3) some structures can be related to late-Variscan fracturing inheritance, by reactivation of basement faults with NNE-SSW and ENE-WSW trends; (4) some anticlines are aligned with exposed salt diapirs, showing lateral continuity between these structures; (5) seismic units geometry of the neighbouring basins is consistent with halokinesis initiated during the Jurassic; (6) 2D/3D seismic data show presence of salt diapirs at depth, aiding vertical movement and local uplift of some structures; (7) geometry and sedimentary filling of the neighbouring basins show relationship to salt-related anticlines and salt walls, with salt withdrawal from the base of the basins (subsidence) and movement into the neighbouring anticlines/diapirs; and (8) evidences of anticlines development and growth into structural highs before the Late Miocene Alpine event. These data suggest that: (1) pre-existing basement faults and their reactivation played important role on the nucleation and development of salt structures; (2) many structures result from diapir tectonics, initiated before the Cretaceous; (3) important vertical movements occurred as the result of regional and local (diapir) tectonics; (4) subsidence in neighbouring basins may have promoted maturation, as shown by surface oil seeps and well data (oil/gas shows); and (5) possible targets with strong potential for hydrocarbon trapping and accumulation may have also developed.