TECTONIC CONTROL ON THE EVOLUTION OF SOUTHWEST IBERIAN BASINS - THE MIRROR-LIKE ALENTEJO AND ALGARVE BASINS

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QUESTION: what may be the origin of orthogonal basins ? conjugate faults ? transform faults ? compressional inversion? other ?

The Western Iberian Margin (WIM) is considered to be related to the **North Atlantic opening,** which started to produce **seafloor spreading** in Lower Cretaceous times (Pena dos Reis *et al*., 2009). The separation between Iberia and North America followed an approximate **E-W trajectory**, as it may be seen from post-Lower Cretaceous magnetic anomalies distribution. This configuration is well established for the Lusitanian Basin (LB, Central Western Portugal) and the Alentejo Basin (ATB, Southwestern Portugal) but is more questionable for the Algarve Basin (AGB, Southern Portugal).

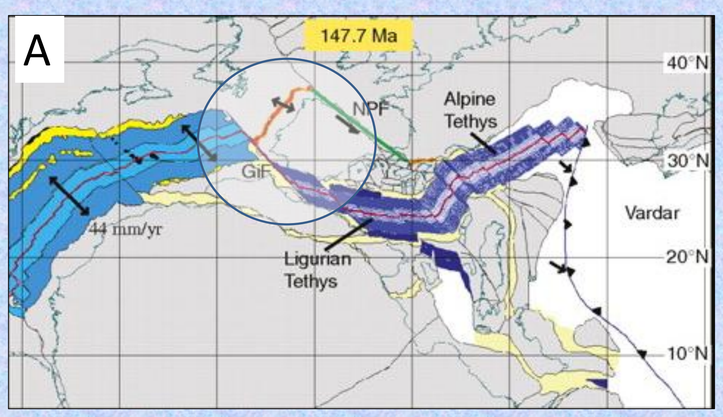
At the present, the AGB outcrops along a broadly **E-W oriented monocline**, facing southwards to the N-African continent, giving a first impression of an **orthogonal orientation** regarding the LB and ATB Atlantic opening. However, the analysis of its regional characteristics, including its predominantly off-shore areas, shows clear **NNE-SSW trends**, not far from the NNE-SSW trends of the ATB. These AGB trends are also quite visible in regional thicknesses variations, with elongated up-lifted basement blocks and **elongated depocenters**, present in different geological times, since the Upper Triassic until the Cretaceous (Matias, 2007). On-shore studies of facies distribution and paleocurrents also underline this regional Mesozoic trend.

This broadly **parallel configuration** of the Alentejo and Algarve basins corresponds in fact more to a **"mirror configuration",** with the ATB showing NNE-SSW lystric faulting, opening and growing and deepening towards WNW (Pereira & Alves, 2011), whereas in the AGB the same structural direction promotes deepening and opening towards ESE (Matias, 2007). These **two mirror-basins** are separated by the Sagres Spur, which corresponds to an **uplifted block** related with the NE-SW Messejana-Plasencia Fault Zone (MPFZ), a very important tardi-variscan structure with crustal expression and Mesozoic magmatism.

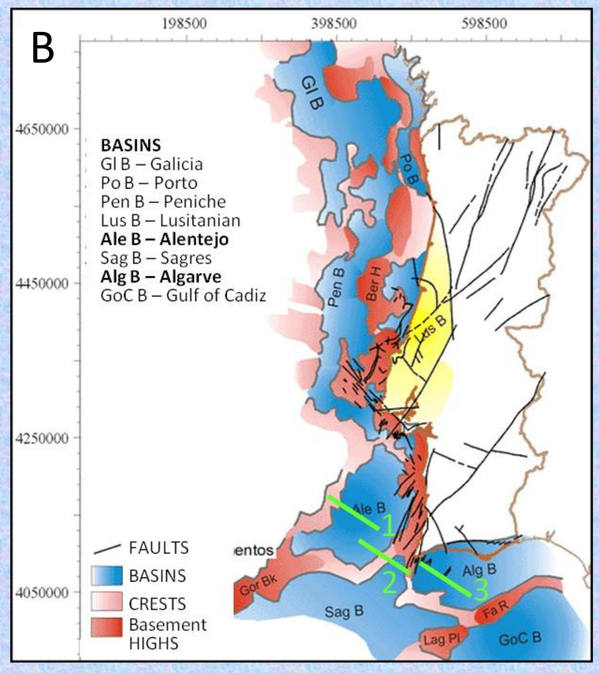
In both basins, there are clear evidences of important geodynamic gradients, with increased stretching towards the outer areas. At the ATB this resulted from the **North-Atlantic opening to the W**, with Jurassic syn-rift units (Pereira & Alves, 2011), whereas at the AGB this resulted mainly from the **Western Tethys rifting to the South** (Matias, 2007).

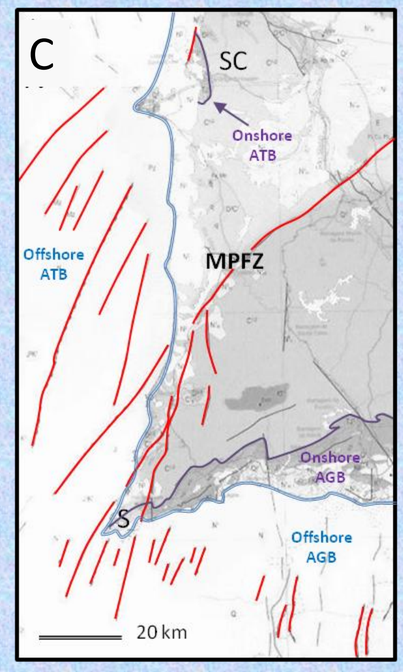
In both basins Late Cretaceous and Tertiary evolution has been controlled by the same **alpine (Betic) compressive episodes** and orientations, related to the African plate collision with the Iberian micro-plate and consequent Gulf of Cadiz allochtonous emplacement. In both basins the Mesozoic infill controlling faults have been inverted, affecting also the Tertiary sedimentary cover.

As a conclusion, it may be stated that the Alentejo and the Algarve Basins share the same late-variscan oriented heritage, **developing in Upper Triassic to Upper Jurassic times mirror-like geometries**, on opposite sides of the Sagres Spur, related with NE-SW lystric faults. However, their Cretaceous evolution is quite different from each other, with continued rifting stretching in the ALB outer areas and an abandoned rift-margin in the AGB.



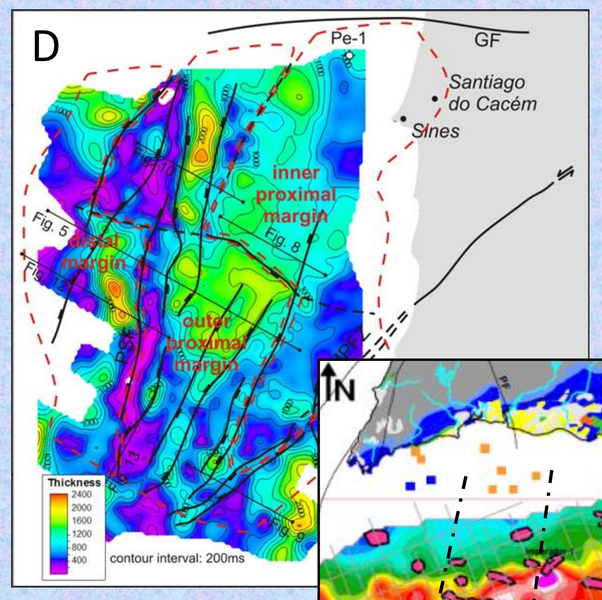
A Geodynamic reconstruction for Iberia in Late Jurassic times. Notice the position of the Alentejo Basin, controlled by the opening of the North Atlantic and the position of the Algarve Basin, controlled by the opoening of the Western Tethys (adapt. From Schettino & Turco, 2010: GSA Bull. *v. 123 no. 1-2 p. 89-105*).

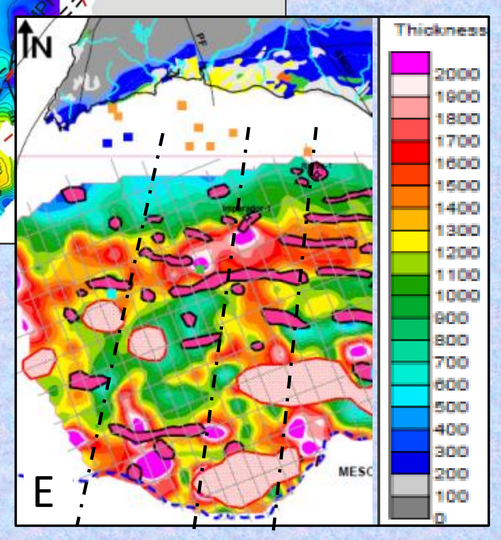




B – Geologic framework of the western iberian basins (adapted from www.dgeg.pt/dpep/pt/geology_pt.htm). **1**,**2** and **3** indicate the position of the seismic lines depicted in Fig. **F.**

C – Structural control of southwestern iberia, with its NNE-SSW main faults (adapted from 1:1.000.000 Geological Map of Portugal).

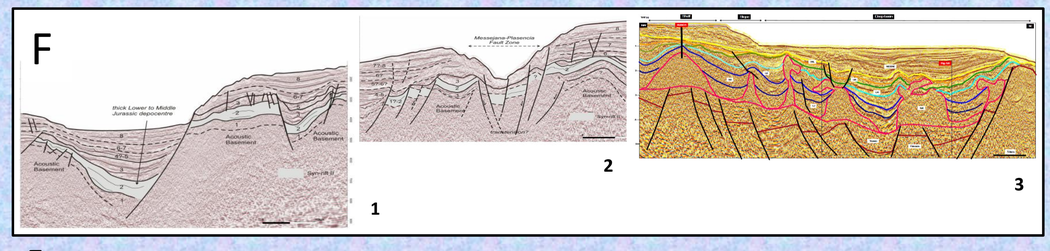




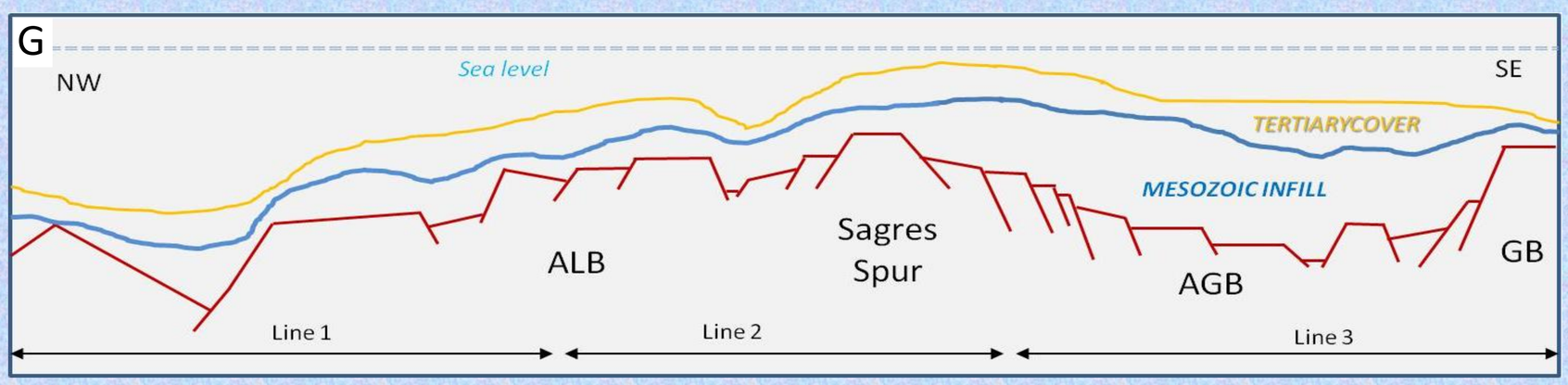
D and E - Mosaic composition of infill thicknesses in SW Portugal basin's.

D - Total TWT (ms) isochron map of syn-rift sequences (Upper Triassic to Lower Cretaceous) (*adapted from Pereira & Alves, 2011*).

E – Thickness of Upper Jurassic infill (*adapted from Matias, 2007*).



F - Seismic lines used to compose the sketch of Fig.G (*vd.* Fig. **B** for location);
Lines **1** and **2** = Fig.12 and Fig. 8, *in* Pereira & Alves (2011); Line **3** = Fig. 6.5, *in* Matias (2007).



G – Sketch of the basement structures and Meso-Cenozoic infill of the Alentejo Basin (ALB) and Algarve Basin (AGB), based on the composition of three interpreted seismic lines (*vd.* Fig. **B** for location). ALB – Alentejo basin; ABG – Algarve Basin; GB – Guadalquivir Bank.

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