Poster Presentation

Low lithospheric stretching in an Atlantic margin - the Lusitanian Basin (West Iberia, Portugal)

Teixeira[(1)], B.A., Pimentel[(1)], N. & Pena dos Reis[(2)], R.

(1) Centro de Geologia, Lisbon University. BernardoAlmeidaFcul@gmail.com; Pimentel@fc.ul.pt
(2) Centro de Geociências, Coimbra University.PenaReis@dct.uc.pt

The Mesozoic Lusitanian Basin (Fig. 1a & 1b) developed in the western Iberia margin and comprises sediments from the Late Triassic to Cretaceous (Pena dos Reis *et al*., 2010). Its evolution has close relations with the opening of the North Atlantic, as well as the opening and closure of the Western Tethys. Two main rift phases are classically considered - Late Triassic (229-199 Ma) and Late Jurassic (159-140 Ma). Three sectors may be defined (North, Central and South), separated by two major NE-SW fault systems - Nazaré and Tagus Valley. The Central sector presents the main depocenter of the basin, with three sub-basins developed in Upper Jurassic times.

Ten exploration wells have been analyzed along the basin. Stretching factors (β) were evaluated through backstripping, mainly for the two identified rift phases. The stretching factor was assessed following the methodology of Le Pichon & Sibuet (1981). For each well a maximum and minimum palobathymetry was assumed, corresponding to the depositional environment of each formation. For the sea-level corrections, two sea-level curves were used - Watts & Steckler (1979) and Pitman (1978).

The first rift related depositional sequence (Upper Triassic) has been reached only in 1 of the wells, in which the rift phase seems to continue and even increase towards the Early Jurassic. In most of the other wells, the Early Jurassic also shows intense subsidence (Fig. 2a & 2b). This situation has been interpreted by some authors as a sag phase (e.g. Pena dos Reis *et al.*, 2010), while others consider it to represent a distinct rift phase (e.g. Alves *et al.*, 2003)

The first rift phase (Late Triassic-Early Jurassic) usually presents higher stretching factors than the second rift phase (Late Jurassic), except for the Central Sector of the basin. Here, the Late Jurassic tectonic re-activations promoted the development of different sub-basins and depocenters, rapidly filled-up by > 3km thick siliciclastics. The subsidence curves show that rift phases aren't strictly synchronous across the basin, with slight variations in time. This may be due to the multiple graben and half-graben geometries of the basin, with fault movements occurring within a 5 Ma time-frame.

Considering the Mesozoic opening of the North Atlantic, the calculated stretching factors are low. For the first rift phase the stretching factors range between 1.02 and 1.19 and for the second rift phase they range between 1.01 and 1.19 (Fig. 1c). In terms of total stretching, the values range from 1.09 to 1.27 (Fig. 1c). Despite some differences between sectors and rift phases, the stretching factors may be considered quite low and homogenous throughout the basin. These low values are interpreted as corresponding to an atlantic basin's margin, close to the unstretched basement to the East. Therefore, the Lusitanian basin, with its thick sedimentary infill, extending over 200km by 100km, may be looked as an exposed "inner proximal margin" of an atlantic non-magmatic basin (*vd*. Pereira & Alves, 2011). However, the over 5 km thickness of the basin's infill may not be explained by these low stretching factors - according to McKenzie (1978), such a thickness would imply β values around 2. Therefore, the role of regional tilting or, more probably, local sub-vertical faulting in upper Jurassic Central Sector sub-basins, should be taken into account to explain the observed thick infill.

Considering the border position of the Lusitanian basin, it may be postulated that a few tens of kilometers towards West, namely in the deep-offshore Peniche Basin, stretching factors could go up to values around 1.5 to 2.0, such as in the west-atlantic conjugate margin, e.g. in the Jeanne D'Arc and Orphan basins. With higher values, not only thicker sequences should be present in the Peniche Basin, but also the Heat-Flow for organic matter maturation should be significantly higher.

References

Alves, T.M., Manuppella, G., Gawthorpe, R.L., Hunt, D.W. & Monteiro, J.H. 2003. The depositional evolution of diapir-and fault-bounded rift basins: examples from the Lusitanian Basin of West Iberia. *Sedimentary Geology*, 162, pp 273-303

Pena dos Reis, R., Pimentel, N., Garcia, A.J.V., Viana, A., & Bueno, G. 2010. Mesozoic subsidence and uplift history of an exposed Atlantic rifting margin – the Lusitanian basin (Portugal). *II Central & North Atlantic Conjugate Margins, Abstracts, pp 74.*

http://metododirecto.pt/CM2010/index.php/vol/article/view/235

Pereira, R. & Alves, T.M. 2011. Margin segmentation prior to continental break-up: a seismic-stratigraphic record of multiphased rifting in the North Atlantic (Southwest Iberia). *Tectonophysics*, 505, pp 17-34.

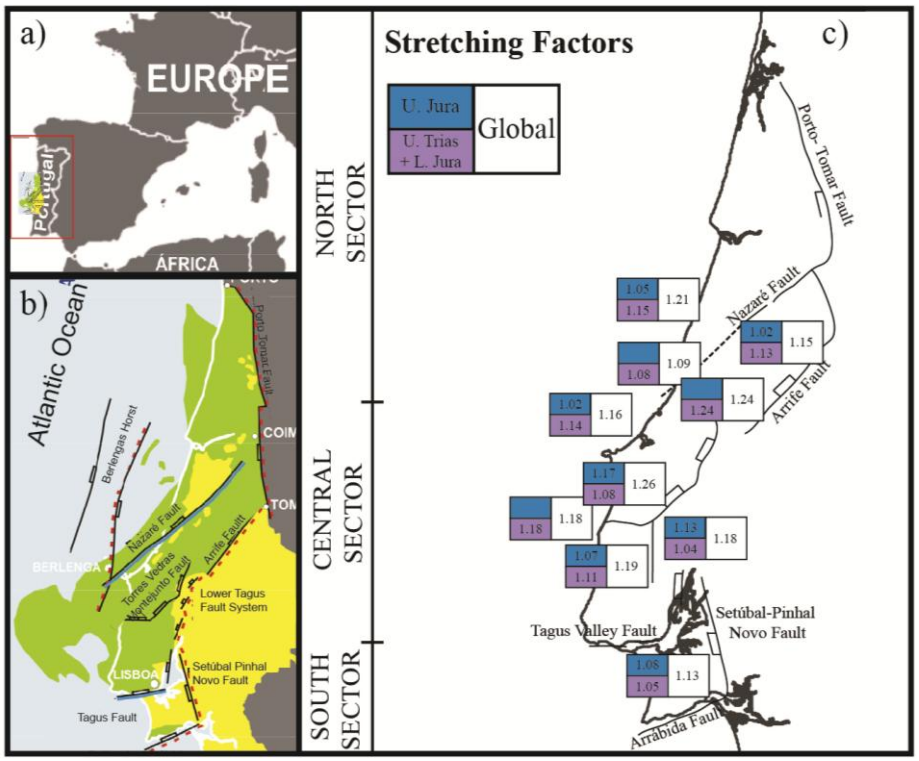

Fig. 1 a) & b) – Lusitanian Basin location (green) and main structures (*in* Matos, 2009).

Fig 1c – Stretching factors (*β*) for the studied wells.

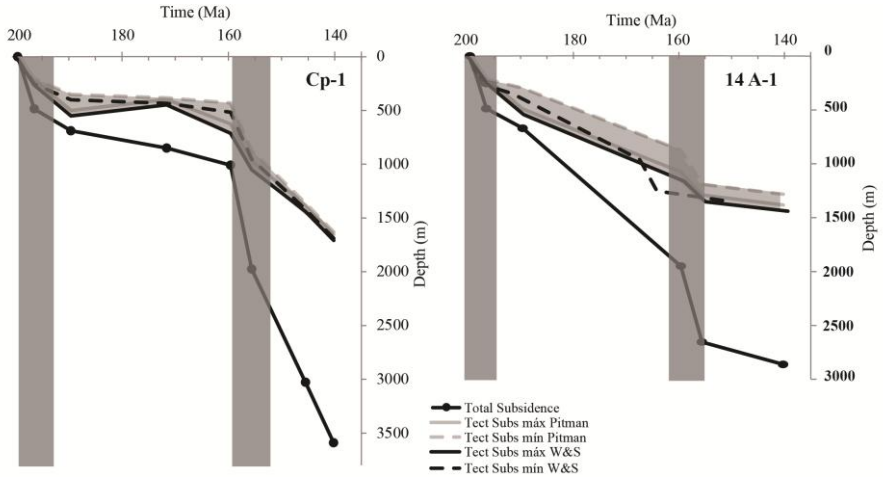

Fig. 2a) & 2b) – Subsidence curves for wells Cp-1 and 14 A-1, with intense subsidence rift phases marked with grey bars.