

PS Alentejo Basin, Offshore Portugal – Deep-Water Interpretation Issues*

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Abstract

Alentejo Basin is located on the southwest coast off Portugal, southwards of Lusitanian and Peniche basins. It runs roughly parallel to the coastline straddling from Estremadura Spur, in the north, towards Sagres Spur, to the south. The basin is rather unexplored although its hydrocarbon potential has attracted attention of the petroleum industry with its very first deep-water well scheduled for drilling in 2018.

Its stratigraphy is marked by basal Triassic red-beds partly filled by postulated mudflats layered evaporite sequences and dolomites. Massive lava flows (200 MA) above the basal rift are characteristic of this basin, with outcrop thickness between 20 to 100 m. Currently, the basin is considered without salt, although volcanics may have blocked salt migration upwards into younger beds, unlike what happens in the neighboring salt basins towards the north without these volcanic rocks. In Algarve Basin, in a context of oblique margin with intensive deformation and embracing volcanic rocks as well, salt diapirs migrate upwards. To note that in the Alentejo Basin the lava layers precludes the seismic imaging of the strata beneath basalt. The well imaged overlaying succession above basalt consists of a sequence of Sinemurian dolomites and thick carbonate and siliciclastic deposits of Jurassic and Cretaceous age.

The basin geology may be reconstructed based on existing legacy seismic, by tying the key geologic markers to interpreted seismic reflectors. The deep-water basin is also delimited by ridge type rift shoulders that compartmentalize it into several mini-basins. As observed onshore in the Lusitanian Basin, the major rift faults probably work as inversion sliding fault planes, during the period from Late Cretaceous to Miocene.

Prospect plays in the Alentejo Basin are represented mostly by anticlines with four-way dip closures and stratigraphic pinch-out up-dip terminations. The stratigraphy of the basin will be better understood after drilling the first well.

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Alentejo Basin, offshore Portugal – Deep-Water Interpretation Progress

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01 INTRODUCTION

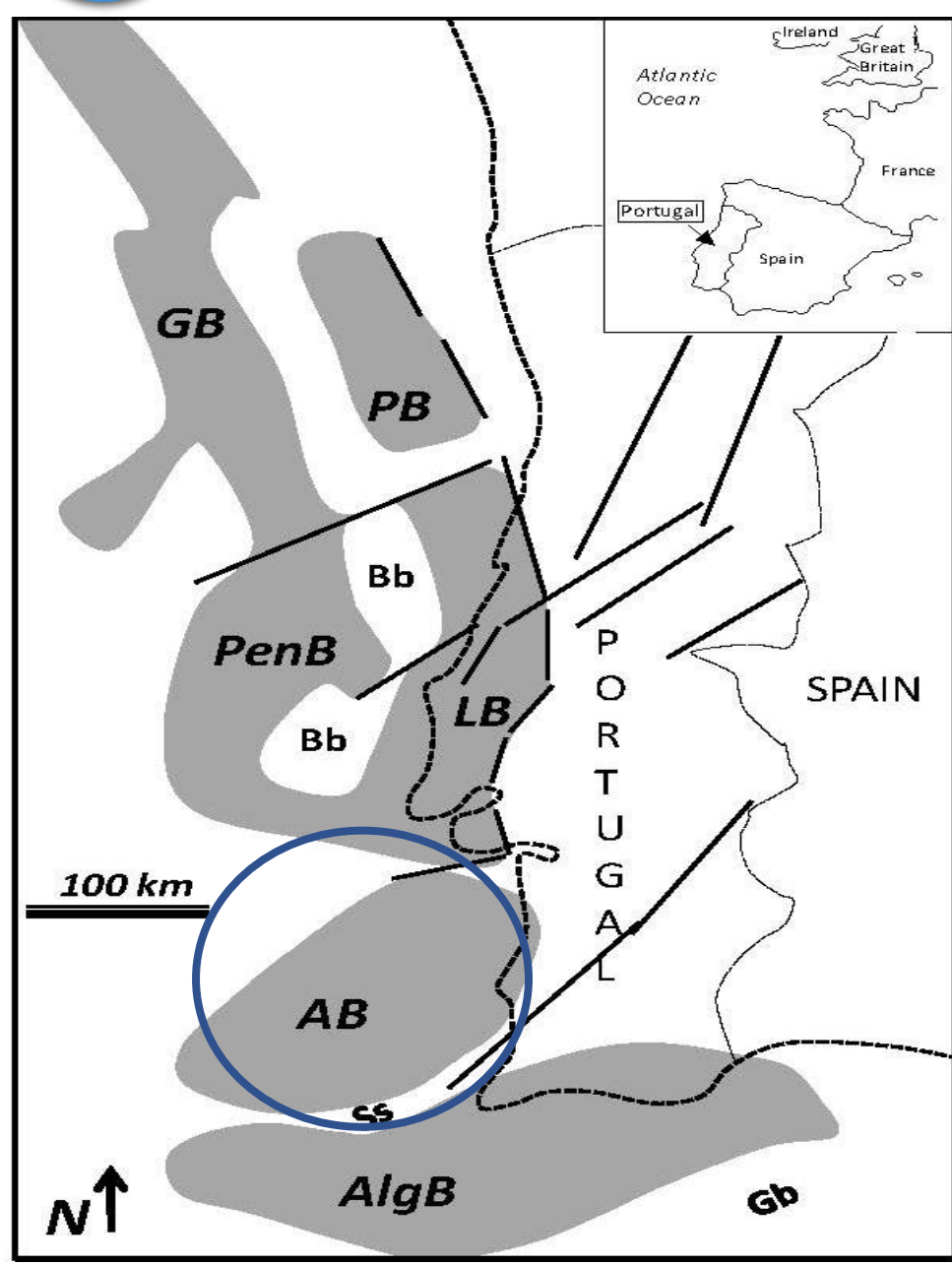


Fig. 1: Geographic location of Alentejo Basin (AB). To the north Lusitanian Basin (LB) and to the south Algarve Basin (AlgB), delimited by Estremadura Spur and Sagres Spur (SS). Pena dos Reis & Nuno Pimentel (2014).

Alentejo Basin is located on the southwest coast off Portugal, southwards of Lusitanian and Peniche basins. It runs roughly parallel to the coastline straddling from Estremadura Spur, in the north, towards Sagres Spur, to the south. The basin is rather un-explored although its hydrocarbon potential has attracted attention of the petroleum industry.

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Prospect plays in the Alentejo Basin are represented mostly by anticlines with four-way dip closures and stratigraphic pinch-out up-dip terminations. The stratigraphy of the basin will be better understood after drilling the first well.

▲ **Initial drilling in the basin is scheduled for the second half of 2018;**

▲ **Resources have been estimated at 1.5 BBO;**

▲ **Region resources may exceed 15 years of Portuguese national consumption.**

02 PETROLEUM SYSTEMS

In the **Alentejo basin** petroleum source rocks and live migrated hydrocarbons are possibly encountered in the Paleozoic, Triassic, Lower Jurassic and Upper Jurassic sequences. The three petroleum systems have been identified onshore and are expected to be present along the offshore basins (Alentejo and Peniche basins), probably with some stratigraphic and shifts related with their inner/outer position regarding the margin's evolution.

Table 1: Alentejo Basin Petroleum Systems and the respective characterization.

Silurian and Carboniferous Petroleum Systems	<ul style="list-style-type: none"> Reservoir Rocks: Alluvial Sandstones (Late Triassic); Regional Seals: Marls (Hettangian);
Lower Jurassic Petroleum System	<ul style="list-style-type: none"> Source Rocks: Marine marls (Pliensbachian); Reservoir Rocks: Alluvial Sandstones (Cretaceous); Seal: Transitional clays (Maastrichtian); Trap delineated by anticlines and stratigraphic pinch-outs.
Upper Jurassic Petroleum System	<ul style="list-style-type: none"> Source Rocks: Lagoonal limestones (Middle Oxfordian); Reservoir Rocks: Fractured limestones and turbiditic deltaic sandstones (Oxfordian/Kimmeridgian); Seal: Marls (Kimmeridgian); Trap: inverted anticlines.

03 MARGIN'S OVERVIEW

Amongst the several un-explored basins that developed along the western Iberia margin, Alentejo Basin is one of the most important. It is closely linked with the northward basins offshore Peniche and Porto basins and the mostly onshore Lusitanian Basin. These are all being the focus of contemporaneous exploratory efforts. They are situated along the western Portuguese coast and their origin are related to the opening of the North Atlantic Ocean. These basins formed as a rifted, essentially non-volcanic, Atlantic continental margin type, trending dominantly on an N-S orientation. The basins are geographically near and roughly parallel to each-other, corresponding to the inner and outer marginal sectors. Sedimentary infill comprises siliciclastic, carbonate and hybrid sediments, with deposition and unconformities related to major tectonic events. Tertiary deposits are significant in most of the offshore basins and tectonic inversion affecting these basins had Late Eocene and Late Miocene alpine climaxes.

Although in the western Iberian Portuguese Margin evaporites sequences are seen throughout the whole of Lusitanian Basin on outcrop exposures and interpreted on seismic on the other offshore basins, the fact is that Alentejo basin is unique in the sense that salt has not been interpreted and appears to be not part of the basin architecture.

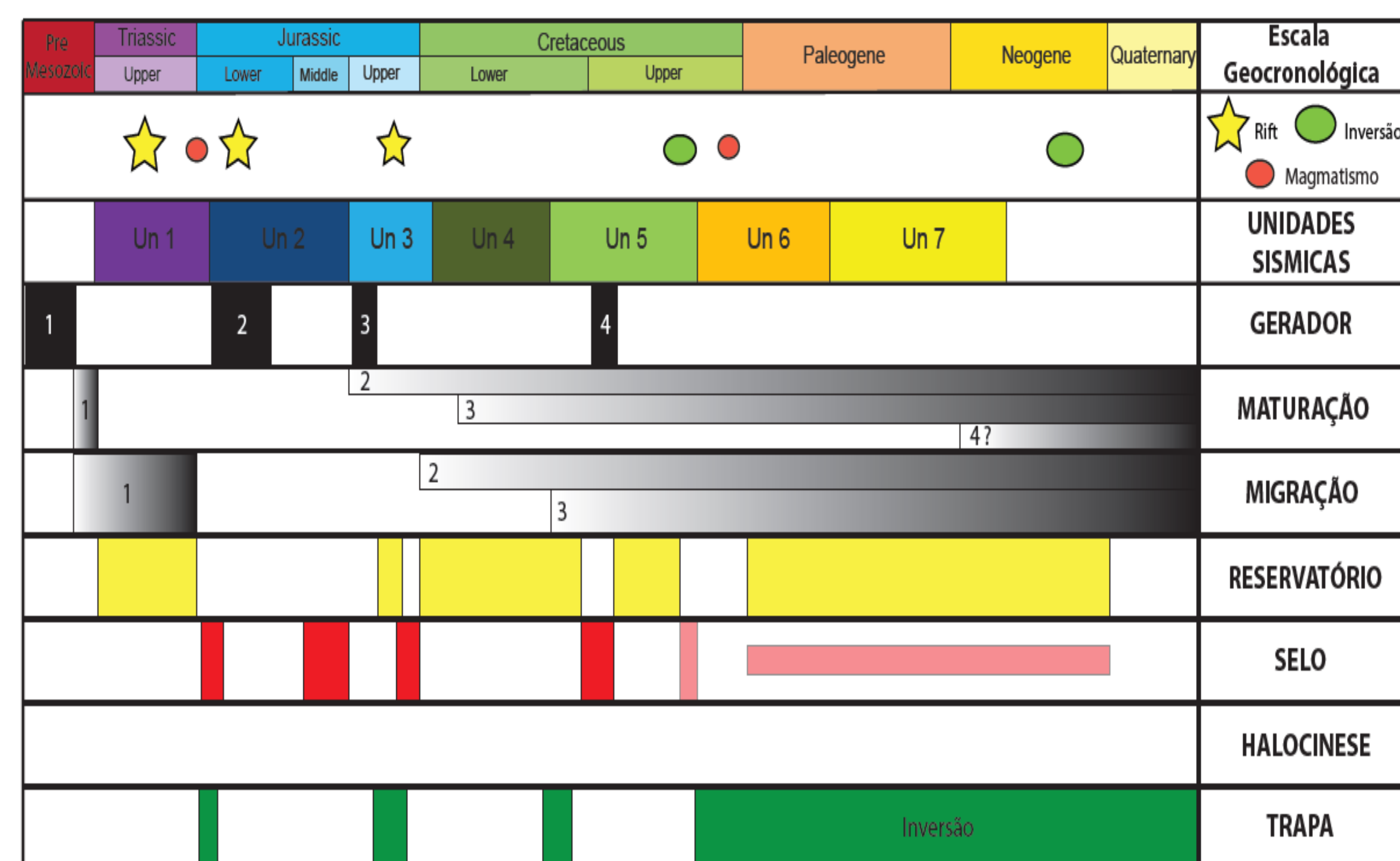
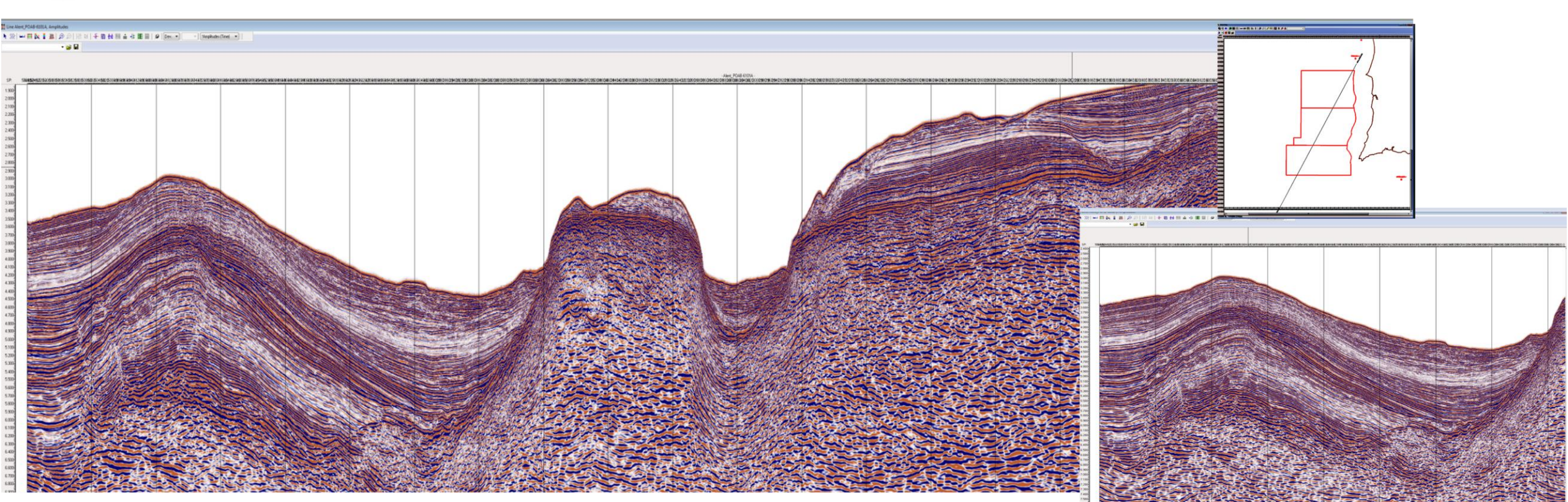


Fig. 2: Presumed Petroleum Systems chart of Alentejo basin. Unpublished.

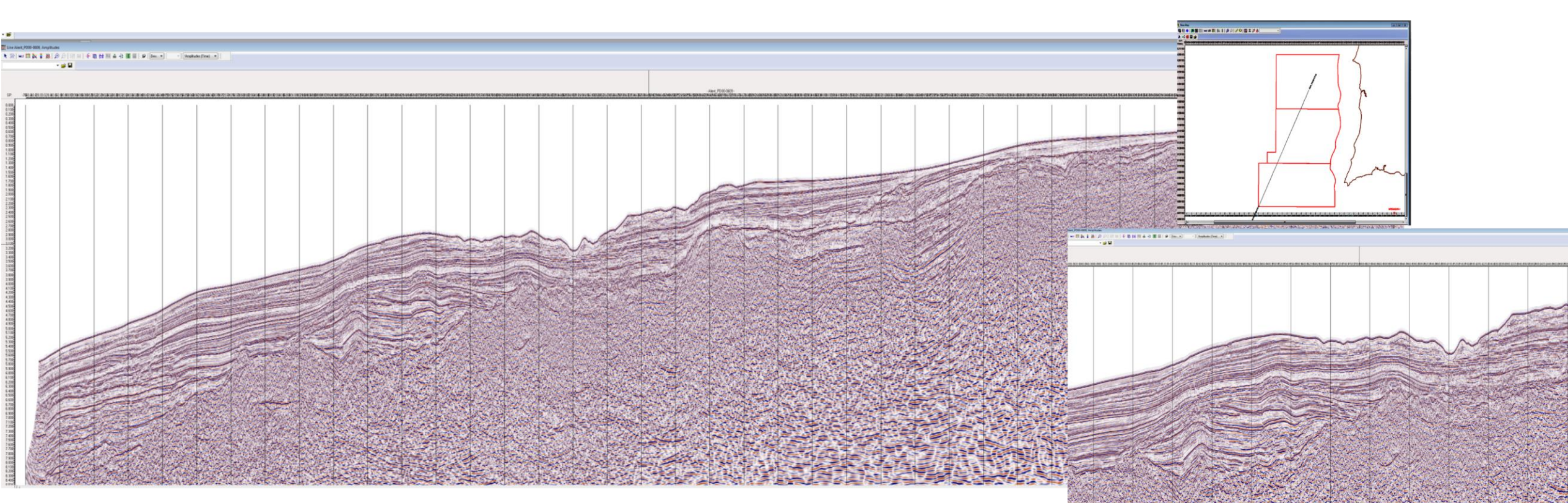
Table 2: Margin's tectonic behavior from Late Triassic to the Campanian.

Late Triassic	➤ Intra-Continental Rifting;
Early and Middle Jurassic	➤ Sag Basin Development;
Callovian	➤ Unconformity;
Late Jurassic	➤ Rifting and Intense Subsidence;
Early Cretaceous	➤ Siliciclastic Progradation;
Late Aptian	➤ Break-up Unconformity;
The Campanian	➤ Early Inversion Unconformity.

04 SEISMIC RECORDS



Courtesy of Petrobras.

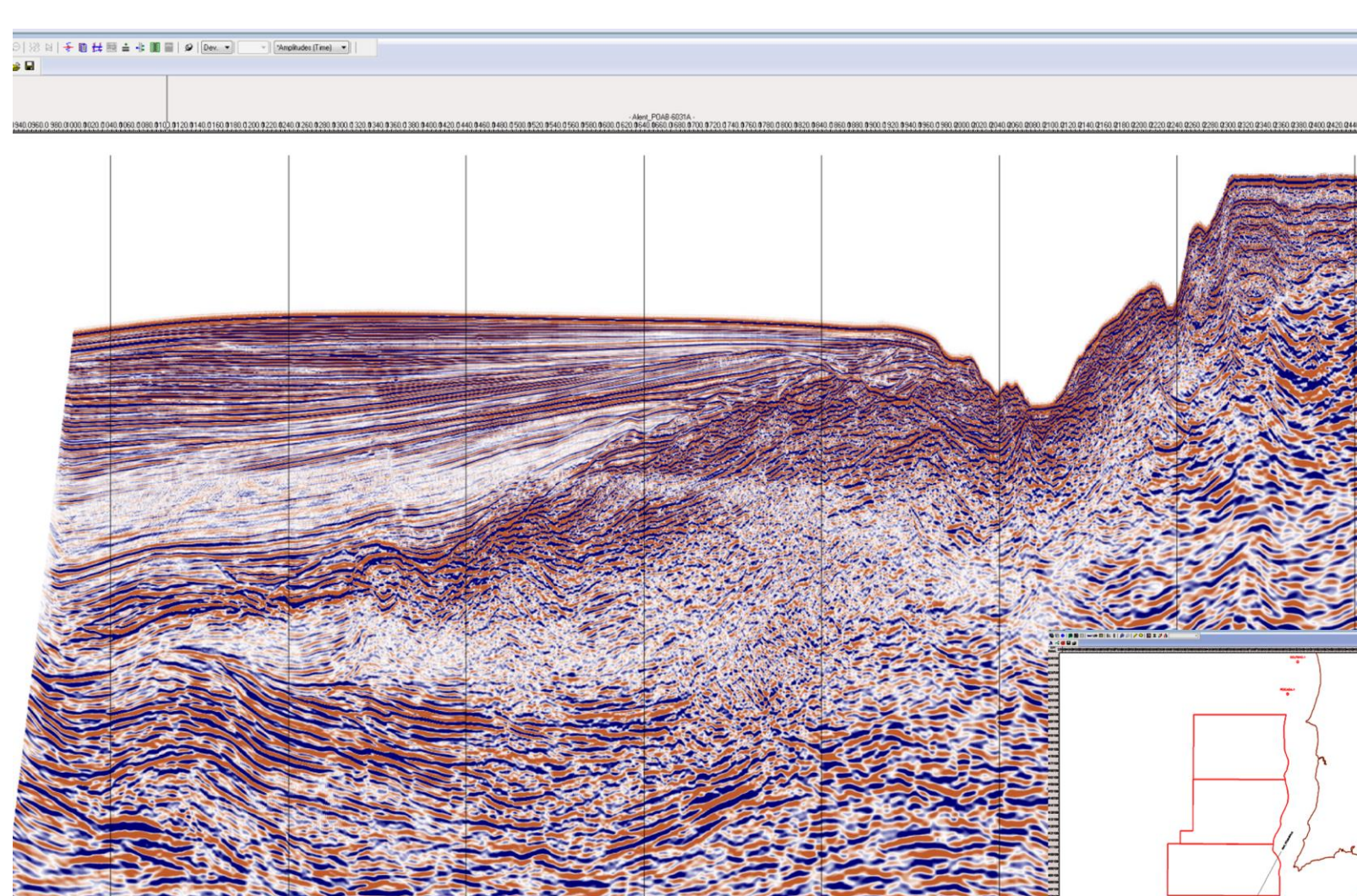


Courtesy of Petrobras.

05 CONCLUSION

By contrast with the other offshore basins of Portugal, salt architecture has not been identified in the Alentejo Basin.

Regional 2D and prospect focused 3D seismic surveys have been conducted recently in the western offshore basins off Portugal. It would appear that the most prospective areas are the offshore extension of the Lusitanian Basin and beyond the limited ridge border the deepwater region of Peniche Basin, both basins with plays delineated by intense salt tectonics. Salt is also present in the offshore Porto Basin, but apparently with no major influence.



Courtesy of Petrobras.

06 REFERENCES

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